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ENGINEERING + FINANCE + COMMERCE

THE PIONEER IN ITS FIELD

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Manila and Singapore Water Supplies

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Electrical Development in Taiwan

Electrical Development in Japan

FAR EASTERN MOTORS

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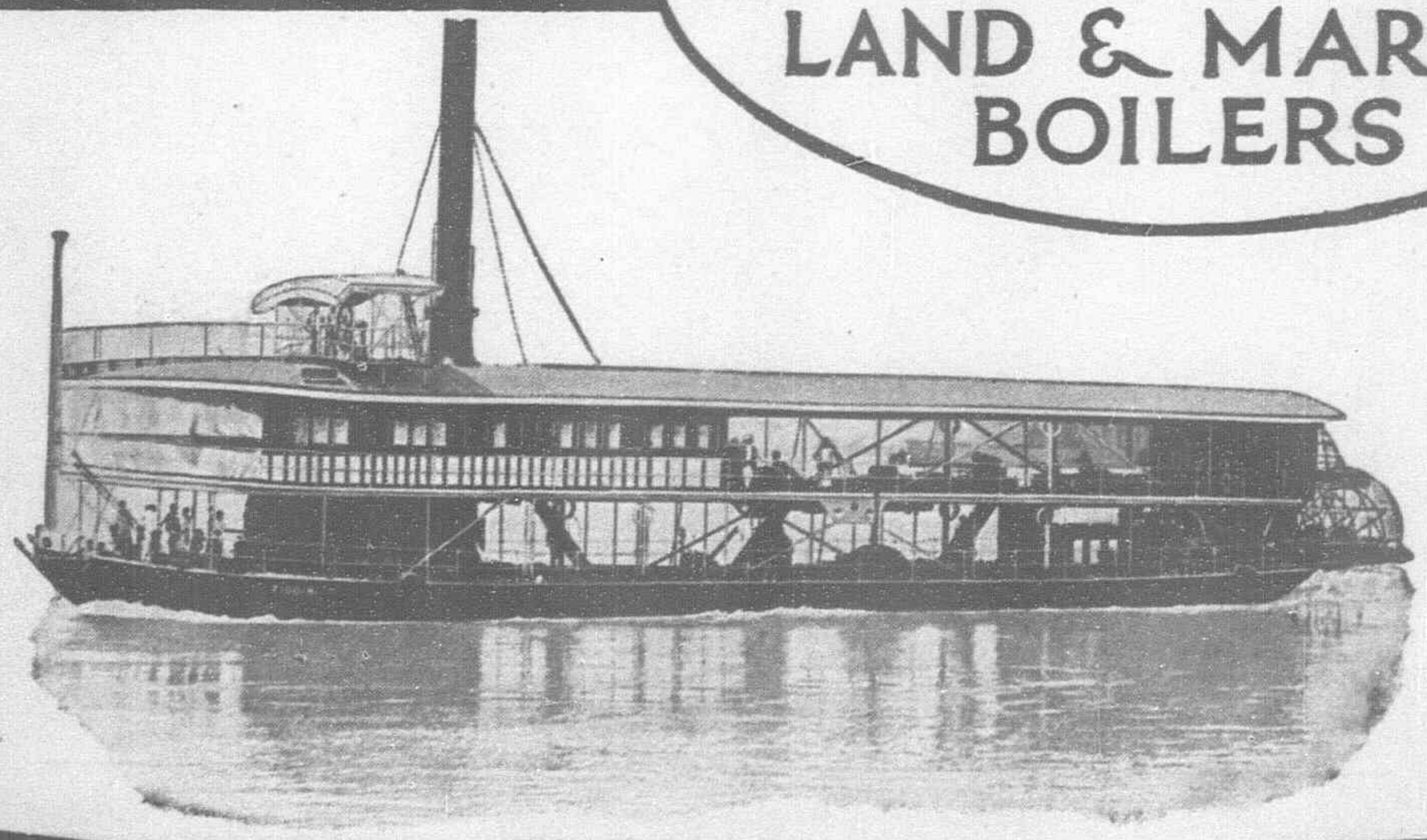

DR. SUN'S MESSAGE TO THE WORLD

"The present lawless and chaotic condition of China is traceable to the encouragement and support extended by the liberal powers to the hirelings of the military oligarchy posing as a government at Peking. If the powers are sincerely desirous of assisting China to regain her feet, they should refuse to pay over the surplus salt and customs revenues to the Peking faction, employing these funds to liquidate outstanding unsecured indebtedness, and holding the surplus in trust for a unified government ot China. These salt and customs revenues now doled out to the Peking government are transmitted to its dictator at Loyang, and employed by him to carry forward his determined campaign to unify the country by the sword and destroy representative government. China can never be unified by force of arms or will the people of the south ever again submit to the autocratic rule of a military despot maintained in power at Peking by the recognition and financial support of outside nations. The great powers fought to make the west safe for democracy; let them practice what they preach in China and if they cannot openly support the liberal movement, let them at least extend sympathy to their own ideals and stand aside in strict neutrality by withholding financial support to Peking while the Chinese settle their own problems in their own way."

Dr. SUN YET-SEN,

First President of the Chinese Republic and Leader of the Chinese Liberal Movement.

Sketched for "The Far Eastern Review" at his home in Shanghai, by Juel Madsen, the Danish artist.

The Far Eastern Review

ENGINEERING FINANCE COMMERCE

VOL. XIX SHANGHAI, MAY, 1923 No. 5

The End of the Road

IN 1917, the American people entered the world war to help defeat a theory of government directed by military overloads having no sense of responsibility towards their own people and with no respect for the rights of other nations—they sent their divisions, their fleets and their air forces to stand by the side of the armies of France, of Britain, of Belgium and of Italy, so that government of the people, by the people and for the people should not perish; that the world should be made safe for democracy.

In answer to the invitation of President Wilson calling upon the neutral nations to join with America in severing relations with Germany, the American minister at Peking at the head of a little group (known to history as the " Flying Wedge ") brought pressure to bear upon the president of China to follow the example of the United States. The liberal leaders of China loudly protested against a step which they knew from sad experience would consolidate the power of the northern militarists and retard the establishment of parliamentary government. They were overruled. China entered the world war under the leadership of the Peiyang military group which used its advantage to uproot by force of arms the growth of democracy in this country. The allies fought in Europe to overthrow a predatory military autocracy which had become a menace to world peace and security, while in Asia, they fastened upon the helpless masses of China the yoke of the same damnable system which has now become not only a barrier to unification but a menace to the peace of the Far East.

The support of the allies and the continued recognition of the liberal powers to the military despots of Peking has encouraged the latter to defy the principles for whose preservation the world was drenched in blood, and to embark upon a campaign within their own country to consolidate their rule at the point of the bayonet and crush the movement for the establishment of representative government. They know, and their advocates know, that once liberalism is established in China, once the machinery of self-government is working, their days are numbered. They are fighting against this, prepared to invite foreign intervention and risk even partition; to carry death and desolation to the futhermost confines of this great country, rather than surrender their present powers. To accomplish these unholy ends, they have plundered, sacked, violated and ravished the country. There is no law, no government, no respect for treaties or international obligations. The government is bankrupt; loans are repudiated and defaulted; salaries of civil officials are months and over a year in arrears; foreign debts remain unpaid; important foreign firms are failing with others on the brink of disaster; armies of bandits scourge the provinces, pirate fleets sweep the rivers, the canals and estuaries; life, property, honor and all that is held dearest by the people are sacrificed, without a move being made by the military overlords to restore order.

The great liberal powers of the west continue to recognize the puppets of these overlords as the government of China. They go even further and hand over the surplus salt and customs revenues which permit them to preserve the fiction of government. When Mexico was ravished and laid waste by hordes of bandits, when foreign life and property were no longer secure, the powers withdrew recognition to the government which held the capital city. Recognition has been withheld from Russia, because of these same conditions; yet for reasons best known to themselves, the powers continue to recognize and make possible the continuance of similar conditions in China.

The powers brought the full weight of world opinion to bear against military despotism in Europe and destroyed it: they focussed world attention upon the militarists of Japan and compelled the people of that country to swing into line with the other liberal nations of the world. They now give the lie to their words of political propaganda and bolster up and make possible the perpetuation of the same system in China.

What is the difference between a European military autocracy with no responsibilty to the people of its country and its Asiatic counterpart, which in the days of Li Hung-chang, could enter into a secret alliance and plunge two nations into the greatest war of history to that date, and keep its own people and the world in profound ignorance of the facts for twenty-five years? What is the difference between a military autocracy which determines to subjugate Europe and the world to its rule, and one which boldly declares that it will enforce its rule in China at the point of the bayonet? Who is to guarantee that this huge fighting machine, the greatest in the world to-day, will stop when it has conquered China? The subjugation of all the provinces by any military overlord, means a huge standing army of occupation to enforce his rule, a continual drain upon the Chinese people and international finance which will foot the bill in some way or other. Who will guarantee, that this great standing army will not be employed in further conquests, that an opportunity will not be sought to try conclusions with Japan, with Russia, or with France over Indo-China? Militarism in China is the same as its counterpart in Europe or elsewhere, it is doubly obnoxious at this time, because its proclaimed program is to throttle democracy and perpetuate the autocratic rule of a military dictator, and, if present tendencies at Loyang can be accepted as a sign of the times, it may mean the restoration of the Manchu emperor.

The day is past when the advance of liberal ideas can be checked by force. China will never be unified by the armies of Wu Pei-fu or any other military dictator. Yuan Shih-kai with all his prestige at home and abroad, with the backing of huge loans and immense internal revenues, with a powerful and efficient army and his henchmen filling all important posts, could not turn back the tide. What Yuan could not do in the hey-day of his power, cannot be accomplished by Wu Pei-fu or any other swashbuckling sword rattler. Wu may defeat the forces of Sun Yat-sen in Kwantung, he may consolidate his rule and bring Fukien, Chekiang, Szechuan and Yunnan under his banner for a time: he may induce the foreign powers to again advance a huge loan for reorganization purposes, but his rule will not endure. Sooner or later the fight will start all over again and the country plunged into another chaos of years. Sun Yat-sen may die, he may be assassinated, he may fall with his troops, but the cause of good government will carry

on. His place will be taken by another and the principles he stands for continue to guide his colleagues and followers. Peace for the Far East and the triumph of the same ideals that brought peace to Europe, can only be attained by the recognition of those same principles in China. The victory of Wu Pei-fu means the victory of a Hindenburg, the triumph of evil over good, the maintenance of a standing army of such proportions that within a few more years, it will be called upon to justify its existence by throwing down the gauntlet to Japan or some other power. With the best of intentions, the powers, in their blind support to the creatures of this boasting satrap, are inviting the catastrophe. The road to hell is paved with just such intentions. China is headed straight for the end of the road.

G. B. R.

* * *

Events follow fast in China. To the long list of outrages upon foreigners is now added the wrecking of the Tientsin-Pukow express train by a band of 1,000 bandits who carried off the 300 Chinese and 27 foreign passengers and are holding them for ransom. Several well-known Shanghai residents are among the prisoners. We have exhausted our vocabulary in past denunciations of a policy which permits one military overlord to impose his will upon Peking and blackmail the legations into extending recognition to his puppets. There is nothing more to add. China long ago reached the conditions which existed in Mexico, but where, because of the policy of the American government, the operation of the Monroe doctrine and other factors, there could be no thought of European intervention. America, through her moral leadership, has extended her doctrine to China, where intervention on the part of any one power for the protection of its nationals would be looked upon as act of aggression. The American government failed to live up to its full demands in the Coltman case, fearful of hurting the susceptibilities of the Chinese, and we have the answer almost immediately in the outrage on the Tientsin-Pukow express. The territory, in which the outrage occurred, lies within the jurisdiction of Tsao Kun and Wu Pei-fu, who, with all their armies and vaunted military ability, could not put a stop to bandit depredations within their own province or own districts. This last challenge of the bandit leaders is the direct answer to the supine attitude of the powers which declines to take any positive action in defense of their interests in China. It is no secret that Shanghai and its vicinity may soon be drawn into the vortex of the internal warfare in China, and with crimes against foreigners in all other parts of the country permitted to pass without satisfactory indemnities and apologies, the immediate future is far from rosy for their safety in this treaty port. Events will soon demand decisive action. Who will take the lead? If America or Britain cannot or dare not, let them step aside, and permit others to assume a leadership that will ensure at least respect for foreign interests in China. We are fast approaching the climax, the "show-down" which will determine whether the concert of powers will continue to play in harmony to the tune which extols the present *regimé* in Peking or take such action as will terminate an intolerable situation. Let us be plain. International jealousies and rivalries in China operate to obstruct concerted action to restore order in China. The situation in Peking is simply a reflex of the old anti-Japanese policies of Americans and Britons co-operating to oust the Anfu and pro-Japanese cabinets and elevate Wu Pei-fu and his underlings. In order to make certain that no pro-Japanese cabinet will control Peking, Anglo-American sentiment would continue to support Wu Pei-fu and see Chinese and foreign interests utterly destroyed, rather than withdraw recognition and support to their favorite. The Wu Pei-fuites are dragging China to ruin and endangering the lives and properties of every foreigner in the country by their blind allegiance to a man who is incapable of imposing law and order in the districts overrun by his armies.

Where will it all end? Only when the gunboats rush to succor and save the lives of foreigners in the larger treaty ports will the deluded diplomats in Peking awake from their dream. Then, it will too late. The responsibility for the Tientsin-Pukow outrage, as well as the inevitable outrages that will follow, will go straight up to those powers whose misplaced sympathies have permitted the present lawlessness to reach that stage where the end of the road is in sight.

The Handwriting on the Wall

Facing Disaster

"TO the next fellow who growls about paying his corporation income tax, you can use the perfectly mild and proper expression, 'Go to China!', where he can form a China trade corporation and become rich in no time." This is the latest slogan in the United States to induce American capital to erect factories in this country, an echo of the previous campaign to bring American firms into China in order to capture the trade by sheer weight of numbers. To such talk may be added the mass of China trade propaganda spread broadcast in the United States and England by official boosters and enthusiastic journalists." More than once THE FAR EASTERN REVIEW has protested against this campaign at a time when China is bankrupt and the country split asunder by civil strife. Over 300 American firms answered the call of three years ago and swarmed into Shanghai, where through their inexperience in conducting Chinese business, they precipitated the financial catastrophe which wiped them out and carried other conservative concerns to the brink of disaster.

Is it not about time that the established hongs in China protested against the continuance of a campaign which can only result in further embarrassment during a period when the most extreme conservatism is required to tide over one of the worst depressions that business in China has ever experienced? These thoughts occur to us as we read of the reorganization plan of Andersen, Meyer & Company which permits this representative American concern to carry on, the news of the liquidation of the old established British firm of Reiss Brothers, Ltd., and the wiping out of the capital of another pioneer British hong, Probst, Hanbury & Company. There are other firms in China who are skimming along on thin ice, carried by the banks and slowly recuperating from the blow of 1920.

The American firm of Andersen, Meyer & Company has been continued as a going concern through its engineering agencies alone. The efforts to save this company from going under with the Pacific Development Corporation has attracted considerable attention in New York financial circles for the past six months. To such an extent was the parent organization hit that its shares of $50 par went below fifty cents not three months ago. According to the *Wall Street Journal* its stock on March 7th

"was worth considerably less than nothing on the basis of current values. The assets, however, have a potential value which only time can establish.

Its largest asset, a $5,500,000 loan to the Chinese government, is in default of both principal and interest since June, 1922.

"The 1922 balance sheet of the corporation will not be issued until late in the year. As of December 31, 1921, after writing off losses and bringing asset values to a basis of cost, the net worth of the corporation was $2.95 a share for the 321,900 shares outstanding. Included were Pacific Commercial Corporation at $803,073, Andersen, Meyer & Co., Ltd., at $522,030 and other investments at $2,818,031. In current accounts there was an excess of liabilities above $3,000,000.

"The banks saw the futility of liquidating the bankrupt concern, because of the possible future value of the company's assets as well as the goodwill of its subsidiaries, and the alternative was to devise some method of financing until the frozen accounts could be freed. Two finance corporations with $2,000,000 capital each were formed, one for the Pacific Commercial Co., the other for Andersen, Meyer & Co. The stockholders of Pacific Development Corporation subscribed to the offering of $1,000,000 of pacific commercial finance corporation stock at $100 a share, but the Andersen-Meyer plan is in abeyance.

"It is expected that manufacturers interested in selling American machinery in China will subscribe $1,000,000 to a proposed issue of préferred to carry on the business.

"Under the original plan it was proposed to grant options to the finance corporations exercisable in two years at $70 a share for the Pacific Commercial stock and $500,000 for Andersen, Meyer & Co., Ltd. If exercised, the return to Pacific Development Corporation stockholders would be $1,583,810. The benefits of any rehabilitation of either of the subsidiaries would accrue only to subscribers of finance corporation stock and not to holders of Pacific Development Corporation. Their position may be set forth as follows:

"Assuming that the Chinese loan is collectable at face value and that other investments and assets could be liquidated at book value as of December 31, 1921, the assets of the corporation would amount to:

Chinese government loan	$5,500,000
Investments	2,818,031
Pacific Commercial	1,083,810
Andersen, Meyer & Co., Ltd.	500,000
Current accounts	4,304,459
Total	$14,206,300

As liabilities are $12,504,125, there remains a potential equity for Pacific Development stock of $1,702,175, or $5.28 a share."

The original plan to create a special finance corporation to take over Andersen, Meyer & Company was abandoned in favor of the machinery manufacturers subscribing to an issue of $1,000,000 of new stock at par fully paid up to provide working capital. It is no secret that the embarrassment of this concern was caused by the inability of the Chinese government to meet its obligations both in the matter of the Pacific Development loan and for materials supplied.

Under the reorganization plan, the position of Andersen, Meyer & Company is materially strengthened by entirely severing its connection with the Pacific Development Corporation and standing on its own bottom with no affiliations other than its own subsidiaries. The new board of directors indicates that its character as the premier American engineering company in China will be maintained. The board is composed of the following officers:—

A. W. Burchard, president of the International General Electric Co., New York, chairman of the Board; C. P. Coleman, president of the Worthington Pump Co., New York; R. F. Herrick, Jr., general manager of Saco-Lowell Shops, Boston, Mass; W. E. Kugeman, vice-president of the American Radiator Company of Chicago; Wm. De Krafft, first vice-president and treasurer of the Baldwin Locomotive Co., Philadelphia; J. W. Doty, president of the Foundation Co., New York; Loyal Victor, law firm of Sullivan & Cromwell, New York; Richard Hoyt, partner of Hayden, Stone & Co., bankers of Boston & New York; A. S. Cobb, vice-president of the Bankers Trust Co., New York; V. Meyer, president and general manager of Andersen, Meyer & Co., Ltd., Shanghai.

The result of this combination makes the manufacturers partners in the firm and indicates that its future energies will be devoted specially to the sale of machinery and engineering supplies, industrial development and construction work. In this case, the engineering business of the firm has saved it from being carried under with the parent corporation.

Somewhat different is the report in *The Times* of March 17 which gives the details concerning the difficulties of Probst, Hanbury & Company, Ltd.

"The report of Messrs. Probst, Hanbury & Company for 1921 states that further losses on stocks and trading amounting to £166,020 bring the total deficit up to £306,578 for the two years of depression. All efforts to induce the authorities to make a refund of E.P.D. to the extent of £217,363 have failed, and consequently the paid-up capital of £300,000 has been practically all lost. The profits for 1922 are estimated at £38,000, from which there is to be deducted some £14,000 further loss on the machinery department which has just been wound up. During 1922 a profit of taels 200,000 (equivalent to £33,490 at exchange 3s. 4 1/8d.) has been realized on that part of the property sold, and a revaluation of the remainder gives an increase of value over that standing in the balance-sheet of taels 14,750 (£19,215). The position at December 31, 1922, is that after providing for losses on investments and writing-off trade marks and premium of the lease of the London office and the preliminary expenses amounting in all to £31,611, and including £24,000 as the net trading profits of the year, the company will be left with a capital of £48,517, exclusive of goodwill, valued at £57,642. It has been decided that a reorganization of capital is the only practicable course, but a scheme, now under consideration, cannot be formulated until the accounts for 1922 are to hand from Shanghai, which, it hoped, will not be later than June. With the prevision of £50,000 additional working capital, the directors consider a profitable business could be continued on present lines."

Here we have a hong established for about seventy-five years which failed to recuperate from the disaster of 1920, and has had to wind up its machinery business. The addition of working capital will enable it to carry on and surmount its difficulties. Coincident with the above news comes the report from London that another of Shanghai's foremost hongs has gone into liquidation. The telegraphic report states:

"Messrs. Reiss Brothers, Ld., of Manchester, trading with China, principally in cotton goods, have announced that an official receiver has been appointed liquidator pending the hearing of a petition for the compulsory winding up of the company. The position is attributed entirely to the fall in value of goods lying on the Chinese markets at the time of the 1920 slump."

This disaster involves one of the largest engineering agencies in China as the concern act as agents for over thirty of the most important British machinery manufacturers. From the above statements it would appear that the British failures can be attributed to the violent slump in piece-goods prices of 1920, and our only reason for commenting at all upon the situation is to invite attention to the hazards incidental to the engineering departments of such concerns, which operated on their own bottom, might have pulled through. These disasters, while deplorable in every way for general business, are especially depressing when considered from the engineering viewpoint. It leads us to express the opinion that as far as possible the engineering departments of general import and export hongs should stand squarely upon their own feet and not be subjected to the fluctuations of general business. Andersen, Meyer & Company comes through a reorganization financed largely by its machinery manufacturers and it will be recalled that only two months ago the engineering department of the great Ewo hong was separated from the parent concern and launched as an independent corporation, in order, amongst other good reasons, that its business would not conflict with the many other activities of the firm. In this wise move, the Jardine Engineering Corporation like Andersen, Meyer & Company faces the future development of China prepared to battle for the business without being hampered by affiliations with other departments whose profits and losses are determined by varying conditions which do not obtain in purely engineering and industrial development.

The situation we face to-day in China could be readily foreseen. In our last September number, commenting upon the financial condition of the Chinese government and its inability to pay for materials supplied, we expressed the opinion that "*unless these unsecured debts are paid within a reasonable time, foreign firms in China can prepare for another catastrophe before which the crash of 1920 will appear insignificant. The market has never recovered from that break and another blow at this time may precipitate the failure of firms who have gallantly weathered the storm relying upon the traditional honor of the Chinese to pay their accounts in full.*" Since writing the above, the three disasters noted have been chronicled. We do not mention the serious condition of Japanese banks staggering under the burden imposed by China's repudiation of her just debts, or the losses incidental to Japanese commercial concerns through continual boycotts and other agitation. That is a different story. The simple truth is that chaos in China is driving many important foreign firms into liquidation and bankruptcy. Yet the powers sits idly by supporting a militarist crew which has sucked the marrow from the bones of China, and refuses to pay their legitimate obligations, while the foremost foreign trading hongs are forced to the wall.

The handwriting is upon the wall for all to read. We quote from the Peking correspondence of *The Times*:

"The evil of militarism is responsible for the evil conditions of the finances. Each condition reacts on the other, so that steadily things are becoming worse and worse. The situation of government employees in Peking is tragic. Many modern-style banks which have arisen of late years will shortly collapse if government indebtedness is not liquidated. Many valuable educational institutions must soon cease functioning if provision is not made for them. Every kind of public work is neglected. Enterprise is everywhere paralysed. Economic development is arrested. The situation of the railways was exposed in an article which appeared in *The Times* last month. Everything indicates that the splendid foreign trade which has persisted in spite of the internal chaos of the past ten years will in the end be seriously affected. Huge foreign interests are dependent upon the foreign commerce. The funded foreign debt of China is dependent on the maintenance of the foreign trade. The whole existence of the state is based upon its commerce, and if the foundation decays what becomes of the state?"

The bankruptcy of the state carries bankruptcy down the line to the foreign merchants and in the end the loss is shouldered by the firms at home. The time has arrived for the powers to take action that will avert more serious disasters.

Wanted: A Leader

"TOO many cooks spoil the broth." Too many powers, too many propagandists, too many high advisers, too many divergent international interests allied with too many factions now struggling for supremacy is one of the many reasons why China is unable to set her house in order. No one foreign power has the courage to make a move that might lead to internal peace and unification. France now claims the undivided interest of the world; Great Britain is busy watching developments on the Ruhr; America has both ears glued to radio receivers listening-in on Lausanne and other centres of European oratory; nobody cares a tinker's damn what becomes of China. As long as self-styled experts could sit around conference's tables and declaim over principles, everybody knew exactly what should be done and how to do it (where Japan was concerned) but like all recipes for political puddings it was easy enough to lay down a formula but somewhat difficult to mix the ingredients in the right proportions and bake it to a proper turn for serving. What China needs is a real *chêf*; a number-one cook who will tell the number twos and "learn-pidgens" what to do and how to do it. Someone must assume the leadership.

The American government seems hopeless when it comes to offering a working program for carrying out theories. So long as principles alone are concerned America can be depended upon to exercise moral leadership, but in practical application, we have a tendency to wait for the British to declare their position and join in with a very meek, "Me Too"! This is exactly the American position on China to-day. Ideals and principles which should influence our attitude toward the internal struggle in China have been surrendered; we have joined forces with the select clique in Peking who are frankly and openly out to make Wu Pei-fu the strong man of China.

Japan is still smarting under the rebuke administered by world opinion for her past activities. Her vital interests, however, remain unchanged; she stands or falls with her huge neighbor; yet in the face of China's certain dissolution her statesmen hesitate to initiate any move or propose any solution that might be misconstrued as a revival of discarded policies. For the present, the only solution advanced comes from Wu Pei-fu's foreign friends. *The Times'* correspondent at Peking, puts forward the same old appeal for a foreign loan that will enable this high-minded patriot to cement his position by force of arms. There is no principle involved, it simply follows the precedent of 1913 in furnishing funds to create a strong central government directed by the strongest military satrap. It is an open secret that Wu is violently anti-Japanese and bitterly opposed to the principles of liberal government as represented by Sun Yat-sen. So the solution of *The Times'* correspondent reduces itself to a political expedient in order that the strong man of the Peking president-makers may be firmly seated in power. There is, nor can there be, any guarantee that Wu can consolidate his rule except by the application of force, which means a constant and wholly unnecessary drain on the central treasury and foreign investors for the maintenance of huge armies, a return to the old Manchu system of subordinating the civil authority to the Tartar general, subjugating and holding the provinces by a northern army of occupation; in no wise differing from the Manchu bannermen who battened on tribute levied upon a conquered people. The success of Wu Pei-fu would simply repeat history and pave the way for the restoration of the monarchy, in fact, we are informed by his adviser through the columns of a contemporary, that public opinion throughout the north is swinging around in favor of this solution. Further news corroborates this testimony. The same men who surrounded Yuan Shih-kai, surround the new military overlord; if he should triumph and occupy all the provinces with his victorious armies, then indeed, would the path to the dragon throne be cleared of all obstacles. It might mean the return of Hsuan Tung supported by the bayonets of Wu or the ascension of the latter by the acclaim of his battalions. At any rate, Wu's success would sound the death-knell to democracy in China, and turn back the wheels of political progress a quarter century. A loan to Peking at this time, means a loan to Wu, the betrayal of liberal ideals by those who talked so loudly not a few years back about making the world safe for democracy.

After reviewing the problem from the financial standpoint, *The Times* says that "the real question for the powers is whether it is wiser for them to relieve the present necessities of China at the manifest risk of prompt relapse into extravagance, or to face the risks and the losses inseparable from her rapidly approaching bankruptcy." *The Times*, in effect, inclines to the belief that it is better to bolster up the present government after a commission has pointed the way, by advancing fresh loans to save actual investments. The British undoubtedly have the most to lose in any general bankruptcy of China and their solution must command the respectful consideration of others who have no great financial stake in the country.

On the other hand, we have the argument of Sun Yat-sen, representing the liberal element, that the country can never be unified by the force of arms; that even if Wu and his northern hordes do succeed in subjugating the south, his victory would be only temporary, or until such time as the southern provinces could renew the fight. Sun further says that if the foreign powers desire to hasten unification let them practice strict neutrality in the internal affairs of China by withholding from Wu Pei-fu the surplus salt and customs revenues which alone keeps his puppets in power at Peking. Sun bases his case on its abstract justice and by appeal to a principle the liberal powers will find difficult to ignore.

British support to Wu Pei-fu is counterbalanced by the attitude of Hongkong in recognizing that its interests will be best served by remaining on good terms with the neighboring city of Canton and the southern provinces which constitute the source of such

raw materials as will permit the growth and industrial development of the colony.

With America disinclined to take any initiative that will convert her moral leadership into a practical force for the solution of China's troubles: with the British in China divided between allegiance to Wu Pei-fu and the recognition that Hongkong's future development depends largely upon harmonious relations with Canton: with France engrossed in her adventure beyond the Rhine, Japan alone remains to propose a program for the restoration of order and good government in China.

Here we are met at the outset by the fact that the Anglo-American combination in Peking backing Wu Pei-fu to win, are almost to a man, bitterly anti-Japanese. In fact, it may be said that their enthusiasm for Wu arises largely from the belief that he is the only leader who can be relied upon to resist Japanese influence. This element is intensely hostile to Chang Tso-lin the overlord of Manchuria and Tuan Chi-jui the Anfu leader, because of their friendliness towards Japan. To the unbiassed observer the civil warfare now devastating China while outwardly appearing to be a struggle for power between rival *tuchuns*, in reality is a bitter fight to prevent Japanese influence from regaining ascendency at Peking. For this reason no compromise short of Wu Pei-fu's triumph by force of arms, can be considered. Foreign support to the King-Han war-lord is the logical aftermath to the long period of international intrigues to checkmate Japan during and after the great war, the prolongation of the campaign to circumscribe her activities and destroy her prestige in China.

Principles and ideals so dear to the heart of the Anglo-Saxon are completely ignored by Wu's supporters or subordinated to a determination to resist at all hazards any attempt on the part of Japan to regain her influence at Peking. As long as this anti-Japanese foreign element continues to exert pressure upon the Chinese authorities, there can be little hope for a peaceful settlement of China's problems by any unification scheme that will bring Sun Yat-sen or the liberal party into power.

Nevertheless, the situation in China is commanding more and more attention in Japan and signs are not lacking that unless the other powers take the initiative and live up to their ideals, Japan may be urged to assume her natural rôle of leadership and demand the adoption of a program that will terminate a most dangerous situation. The powers agreed upon the abstract principles to be applied in China at the Washington conference, in which Japan was induced to surrender many of her favored positions and reverse her old policy. Japan has swung from the extreme of militarism to the extreme of moderation in her dealing with China and with the exception of the Kwantung lease and some of the Nishihara loans there are no serious questions outstanding between the two nations. The cancellation of the Lansign-Ishii agreement and the floating of a Japanese government guaranteed loan in New York for development in Korea and Manchuria indicates that America has faith in her good intentions. Once Japan's good faith is established and the other powers are satisfied that she harbors no ulterior designs upon the integrity of China, the way will be clear for her to assume her natural rôle in Eastern Asia.

The Japanese press reports that the policy of the government is now being rewritten into what may be called for want of a better word, a new interpretation of a Japanese Monroe doctrine, based on a loyal acceptance of the spirit of the open door and respect for the territorial integrity of China, a doctrine that will bring the two nations into the closest harmony for mutual economic development. The program is essentially liberal and rejects any further interference of the Japanese military party in diplomatic affairs and looks forward to persuading China to disband her armies and enter the ranks of liberal nations. Japan will follow the precedent of the United States in declaring the doctrine and assume a special position which makes it essential that the two nations shall stand together for the preservation of their common independence. The program calls for the amicable settlement of all outstanding questions between the two countries and for such assistance to China as will hasten the unification, peace and happiness of the country.

These are merely the barest outlines of a policy which, if adopted, and acted on without undue delay, will restore to Japan a paramount position in Eastern Asia and permit her to assume a leadership which the other powers are showing themselves incapable of exercising. Standing on the platform of John Hay, prepared to guarantee the future integrity of China, and demanding of the world that it recognize her right to such a leadership, there is little doubt of what the answer will be.

* * *

The Nishihara Loans

An Appeal from Kobe

OUR attention has been invited to the following quotation from MacMurray's "Treaties With and Concerning China" which appeared in an article on the Nishihara Loans in our February issue:

Commenting on the Sino-Japanese military and naval agreements of 1918 MacMurray says in his introductory note: "It need scarcely be said that both agreements contain no such stipulations whatever as will go towards disturhing the peace of China or encroaching upon her sovereignty, as has been understood to be the case in a section of the Chinese public. It must be clear from the agreements that they have been made entirely for the purpose of China and Japan participating in the allied operations, of facilitating defensive measures against the enemy, and of taking the steps to meet the urgent exigencies of the situation. There is nothing clearer or more impartial then the evidence of this eminent authority."

The above introductory note was, in effect, a translation of the official statement made by the Japanese government on the occasion of its publication of the military and naval agreements of May 1918, more familiarly known as the war participation pact. It is not an expression of opinion on the part of the compiler.

While relieving the chief of the far eastern bureau of the state department from any responsibility for expressing such an opinion, this correction does not weaken the statement that the war participation pact between Japan and China entered into three months before the American government dispatched its troops to Siberia for the identic reasons set forth in the pact, was of incalculable benefit to the allied cause. Whether the statement is that of the Japanese government or the opinion of an American official does not alter the fact that the agreements were entered into for the reasons set forth in the introductory note. Upon the legitimacy of this agreement hinges the validity of the loan advanced by Japan to China for the purpose of enabling the latter to carry out her obligations under its provisions as an ally in the great war and automatically involves the arms contracts which followed as a matter of course.

These and other loans were advanced in good faith by the three semi-official Japanese banking institutions at the request of their government, and they have since staggered under the burden of paying the interest to the bondholders in order to preserve China's credit. They now face the prospect of repudiation of both principal and interest. We believe that certain of these so-called Nishihara loans were eminently proper and that any propaganda in defense of their repudiation can only result in encouraging China to extend the principle to other loans and bring further hardships on foreign creditors. Amongst the Nishihara series of loans are other deals which cannot be readily defended but even here there is no call for actual repudiation. The Chinese government officials received the funds and appropriated them into their own pockets, and the

present authorities dare not prosecute them. We believe, with many sensible Chinese with whom we have discussed this subject, that when the proper time arrives a suitable compromise can be effected with the Japanese lenders. They might be settled by the repayment of the net amount received, plus a fair rate of interest and the surrender of the rights given as security.

We are fully aware that many of these loans have aroused considerable antagonism throughout China; we also know that the foreign leaders of the anti-Japanese movement have lost no opportunity to use these loans as an argument for the furtherance of their own campaign, but we fail to see how any honest end can be served by advocating their repudiation at a time when the Peking authorities are seeking reasons to justify the default of payments on other admittedly legitimate obligations, which, on analysis, are on a par with some of the much abused Nishihara transactions. If the latter are illegal then several foreign loans other than Japanese, fall into the same category and the agitation simply provides an excuse for the Chinese to repudiate these also.

It is difficult to understand just what is behind the continued agitation to discredit all the Japanese loans to China during the war period, for, to our certain knowledge, the campaign is not encouraged by many of the most prominent Chinese officials, whose main desire has been to obtain an extension of time in which to repay them. Chinese opinion is divided on the question of the repayment of these loans. A large number of highly placed officials recognize them as a just obligation but ask for an indefinite postponement of payment or a renewal of the agreements which will cover the unpaid interest. Others, even amongst the southern leaders, admit that certain of these loans are legal and must be paid, but they balk at the others and advocate repayment of the net sum received, not the nominal amount of the loan. Few Chinese officials of prominence can be found who will openly advocate repudiation of all the Nishihara loans. The agitation for repudiation is traceable to sources inspired more by an unreasoning hatred of Japan than by any overzealous regard for China's interests.

This fact is borne home to us by an editorial appearing in the *Baltimore Sun* of February 23 entitled "What is the Truth About This"? It refers to a letter to the editor from John Brailsford of Kobe, in which the correspondent evidently had some very trite things to say about the American government sanctioning the inclusion of the Nishihara loans in any consolidated debt scheme secured on the prospective increase in customs revenues. The editorial says:

"John Brailsford, whose letter from Kobe, Japan, was published on the editorial page of *The Sun* yesterday, is a correspondent of distinguished ability and recognized standing. He is not a sensationalist and has a conscience as well as a brain. . . . Such a letter as that of yesterday demands a straightforward answer from the state department. It demands that sort of answer for two reasons: First, because it seems to reflect on the honor and humanity of the government of the United States if Mr. Brailsford has got his facts straight. And second, because it appears to furnish evidence of our curiously dark and devious foreign policy.

"According to Mr. Brailsford, the diplomatic representatives of the United States at Peking have combined with the diplomatic representatives of Great Britain, France and Japan in attempting to force the Chinese government to apply to the payment of a questionable debt part of its expected increase in revenue from the higher tariffs allowed at the Washington conference. The debt which the ministers of these powers ask to be given a special position of advantage includes what Mr. Brailsford describes as 'the notorious Nishihara loans, foisted upon China through corrupt politicians —men who were glad to pawn anything they could pawn to the Japanese lenders in order to get a rich share of the loan moneys for their own use.' In other words, the United States is charged with lending itself to the promotion of a deal that is largely in the interest of a cold-blooded game of international graft. And it is alleged to be using the apparent liberality of the Washington conference for the benefit of the loan grafters. . . . The state department owes it to the country to prove that we are not engaged in such an unmerciful and suspicious transaction. The country has the right to know whether it is being used as a catspaw for the benefit of unscrupulous international usurers, who have been sucking the life blood from a helpless country in whose rescue and reconstruction we have been affecting the greatest interest and sympathy."

We can understand why the Peking camarilla who backed Wu Pei-fu for the purpose of turning out the Anfu officials and destroying Japanese influence in China, made tho welkin ring over the Nishihara loans. They, at least, had a well defined motive. We cannot understand, however, why a correspondent writing from Japan should take upon himself the task of denouncing any plan approved by the powers for the liquidation of unsecured debts among which are included the legitimate loans of the three Japanese official banks. It is safe to wager that the distinguished Kobe correspondent very carefully omitted to send to *The Times* or other prominent British newspapers, a similar letter accusing the British government of being engaged in a cold-blooded game of international graft, and calling upon the secretary of state for foreign affairs to explain.

* * *

The Looters

The Other Side of the Story

SINCE writing the above, the Chinese newspapers of Peking have given prominence to the result of an investigation concerning the wealth of the super-*tuchuns*, ordinary *tuchuns*, simple governors and statesmen and every day grafters in high position, disclosing that 71 such embezzlers are worth over a million dollars, the total of their wealth coming to the huge sum of 631,000,000 dollars. Some GRAFT! Tammany or Russia in their palmiest days could sit at the feet of these sleek mandarins and learn much wisdom. According to the report, the properties of these leading boodlers, if confiscated by the government because they have been secured through corruption, embezzlement, graft and oppression of the people, will be more than sufficient for the repayment of all of China's foreign indebtedness and still have enough left over to pay for the disbandment of the rabble armies which perpetuate the system.

In commenting upon the Chinese financial situation, the papers frankly admit that the present *tuchun* government at Peking only enriches the militarists and their immediate *entourages*, while all classes of civil servants, employees, diplomats, students as well as the merchants and farmers are suffering from the exactions of the tax gatherer. They also admit that China will become bankrupt unless the people rise up as one man against the militarists who are fighting for personal interests in various parts of the country, while the "*Shih Pao*" says that in pursuance to the Washington treaties, the powers should render friendly assistance to the Chinese people in their efforts to get rid of the dangerous, corrupt and disorganized militarists and their mercenary armed coolies, otherwise foreigners and natives cannot enjoy peace and order or pursue their legitimate commercial occupations in this country for many, many, years to come.

From this, it begins to look after all that the Chinese people may start that counter movement inside the country and apply the boycott methods to the boodlers and demand to know, "Where did you get it"?

Here is where the money of China has gone to; deep down into the pockets of the officials, who have invested it in property in the foreign settlements, in shares of foreign companies or have it safely deposited and drawing interest in the foreign banks, all outside the jurisdiction of the Chinese government. This is why it would be a crime at this time to lend further sums to the puppets of Wu Pei-fu at Peking, or to any other cabinet appointed by a military overlord. And this is why, in protection of their own interests, the powers should listen to the advice of Dr. Sun Yat-sen and withhold any further payments of the salt and customs revenues to the present Peking government. If their own interests are not sufficient to move them to take such a step, then the interests and welfare of the masses of China, the furtherance of liberal ideals, and the prospect of restoring trade and confidence should influence them to take a step that will convey to the military dictator of the

Kin-Han and others of his ilk, that the foreign governments will no longer be a party to or an accomplice in the jolly old game of beggaring the country.

The Kobe conscience alluded to in the previous article would imply that the "blood-sucking usurers of international finance" were standing together to rob the Chinese people, but the evidence from Peking shows where the money goes and where it will continue to go just so long as foreigners can be blackmailed into advancing further funds to keep the freebooters in power. With actual bankruptcy confronting the government; with all classes of civil servants without pay: with foreign loans repudiated and defaulted: with foreign firms failing and on the brink of financial collapse, the powers sit idly by in Peking doleing out the money that permits the leeches to cling to the victim, and enables a military oligarchy to mock and make sport of principles that the flower of western manhood cheerfully laid down their lives not five years ago to maintain. The Chinese people are responsible for their own government, but the powers are responsible to their ideals for continued recognition to a system which puts to blush the Villa *regimé* in Mexico and stands on a par with the Soviet in its treatment of the people. The powers refuse to extend the hand of fellowship to Moscow, but they continue to recognize, bolster up and maintain in power a group of military despots whose exploits put Moscow to the blush.

American Co-operation in China

A Plea for the Overworked, Underpaid Wheel Horses of the American Foreign Service

THERE is a bill pending in congress designed to place the American diplomatic and consular service on a higher plane of ability and usefulness. If the bill becomes a law the larger investment will certainly make for greater efficiency and the employment of a higher grade of officials. With salaries cast on a decent scale, with better assurance of longer tenure of office in dignified capacities and with a more sensible system of rewarding merit, the foreign service of the United States should improve rapidly. Speaking for the service in China it would seem that a reduction in the general administrative expenses to carry on the American government in this country and a return to a one department organization under the secretary of state would somewhat lessen the burden of taxation at home and make for greater efficiency by eliminating duplication of energies, especially on the part of officials of other departments who rely to a large extent upon the consular service for their ability to operate. It is not generally understood that in order to keep abreast of other nations the American government has embarked on a program of peaceful penetration in China which calls for an administrative system as elaborate as any required for the supervision of its insular affairs. With a total of 412 firms and 8,000 individuals registered in this country, we find every department of the federal government with the exception of the interior, represented by officials on the ground. Americans in China are enjoying to the full all the benefits of extra-territoriality with the added advantage of being exempt from taxation if they register under the China trade act. These truths were brought home to us while listening to the speech on "Co-operation" delivered by Judge Charles Sumner Lobinger at the dinner recently tendered by the American community of Shanghai to Consul-General Cunningham on the occasion of his completion of 25 years of public service.

It came somewhat as a surprise to learn how deeply the American administrative system had penetrated into China, that the only one of the federal departments which has not at some time been represented, is the interior department, and we gathered the impression that only the difficulty to find a suitable excuse was all that prevented it from being here. In order to bring out how closely the various department officials had always co-operated for the advancement of national interests in China, Judge Lobinger reviewed the development of American official representation in this country. He told how the navy department had furnished several of the early commissioners and how in later years the various admirals of the China squadron and the Yangtze patrol had protected national interests by cordial co-operation with the consulates; he told how the state department for many years exercised almost unlimited judicial powers through the consular service and how these prerogatives were subsequently taken over by the supreme court for China; how the postmaster-general's department so efficiently operated for many years the post office at Shanghai; how the department of commerce entered the field with a commercial attaché and then with trade commissioners which took over the economic work of the consulates, and then appointed a registrar of companies to supervise the China trade act corporations; he enlightened us as to the existence of the representatives of the departments of justice, labor, treasury, shipping board and other special bureaus, and the presence of a military force which has recently been organized into a separate command. He emphasized how each and all of these various officials had always been inspired by the most cordial spirit of co-operation in their endeavors to advance the interests of the nation.

To those who have insinuated that co-operation amongst Americans could not exist, Judge Lobinger pointed to the splendid harmony characterizing the relations between the various federal officials in China, and although it was not stressed, the audience could gather some idea of that sympathetic understanding which binds together the court and the consulate and the splendid team-work between the consulates and commerce departments, all of which refutes the insinuation that Americans cannot co-operate. In summing up, the judge pleaded for still greater co-operation between American officials and their nationals; a wonderful address, one which should have been delivered in the halls of congress, where its full import could have been digested.

As the applause which followed his words swept over the banquet hall, our eyes turned to the honored guest of the evening and beheld the familiar type of the traditional American official grown old and grey in the service of his country, and as we followed his quarter century wanderings from Bergen to Durban, thence to Bombay, Singapore, Hankow and Shanghai, we suddenly realized that this tried and true public servant had reached the zenith of his career, the top of the consular ladder, in charge of the most important consulate-general in the American service. Twenty-five years of earnest endeavor, adherance to duty and advancement of his country's welfare abroad, had brought its great reward, a salary of $8,000 per year (last year cut to $6,000); a public dinner to commemorate his survival and the prospect of having his photograph adorn the dusty walls of the consulate when he is relegated to private life or passes on; not even a pension to look forward to when the inevitable day of retirement arrives.

Our eyes wandered back to the face of the last speaker, the popular judge who only a few months since was similarly honored by his compatriots on the occasion of his vindication from charges preferred against him by a local attorney. We saw here another public servant who after twenty-five years of service on the bench

is worth just $8,000 a year to his government. He, however, is consoled by the fact that when the axe falls or the day of retirement can no longer be staved off, he has a valuable legal experience to fall back upon. He can live and remain active. He operates with a full staff; prosecuting attorney, court clerk and officials, stenographer, marshal, jailer, etc , with an adequate appropriation and an official organ for carrying on the work of justice: a little supreme court for Americans in China complete in every detail, except—the jury.

We remembered that he was a great and good judge who had been personally honored by his president, and as we pondered, our eyes caught sight of a young consular official drawing the magnificent salary of $3,300 a year, and at another table sat another young man worth just $2,500 a year to his government. We recalled that these two unassuming, retiring, yet highly efficient assistants to the consul-general were Chinese scholars, who act as judges in the local mixed court—assessors they are officially called—who daily pass judgement on cases ranging from the misdemeanor of kicking a rickshaw coolie to homicide; from passing a simple jail sentence to condemning a man to be shot; from petty larceny charges to civil suits involving millions. We recalled that these two modest young Americans whose names are hardly known outside the consulate, had attended 745 mixed court hearings during 1922, that two-fifths of the immense judicial work of the settlement devolved upon them, and we marvelled at a system that could pay one dispenser of justice $8,000 a year and expenses with a complete working machine to try Americans without a jury, and permit its junior consular officers to do the same, if not more important work, for $2,500 a year, the salary of a ward heeler doing duty as police court doorkeeper at home. From the decision of the judge of the supreme court of the United States for China, the dissatisfied can appeal; from the decision of the two young $2,500 a year officials in whom the integrity and honor of America is typified for the great masses of China, there is no appeal. Charges may be brought before the authorities at home if the American judge is remiss in his duty, but as far as we know, there have been no complaints on the part of the Chinese that our consular officials have failed in their duty to dispense justice with equity. Such a record is worthy of the highest praise, one that should not be overlooked in summing up the development of our federal official system in China. Surely here was a phase of co-operation and co-ordination that the good judge might have dwelt upon had he not been a federal officer himself.

Had the speaker been a private citizen, he might have advocated that the consular officials detailed to dispense justice in the mixed court be selected with as great care as the judge appointed by the president of the United States to the bench of the supreme court at Shanghai; that these men should form a separate corps in the China service, picked for their efficiency in the Chinese language and legal attainments, and, paid accordingly. They try cases as important at times, and at other times of greater importance, than those which come before the federal judge. Why should a jurist of prominence on the American bench be sent to China with a salary of $8,000 a year, with a complete staff and ample appropriations to try cases under the American law, and a junior consular official just graduated from the student interpreter class, be expected to dispense the same justice to Chinese at a salary of $2,500 a year? This is not justice either to the Chinese or the young men expected to uphold the honor and integrity of the nation under such trying conditions.

Still thinking over these matters, our eyes lit upon another young man representing the department of commerce, a specialist in his line, whose stipend was equal to that of the consul-general; we turned and saw a young lady recently elevated to the rank of trade commissioner, drawing a salary of $5,000 a year: we recalled that somewhere at home we had a commercial attaché who is paid a salary of $8,000 a year with mileage and other incidentals for his contribution to the advancement of American trade interests in China. He has a special office at Peking and a branch at Shanghai and we learn that the system is to be extended. Yet, we do not detract from his rare ability, when we state that a large part of his brilliant success is due to that wonderful spirit of co-operation extolled by the learned judge which makes of the consular officials throughout China a part of his staff. The consulates unearth the information, keep the commerce department informed of new developments in their territory, while the department of commerce gets the credit, the glory, the appropriation and the large salaries. During the year 1922, the $6,000 a year consul-general at Shanghai and his staff held 108 interviews with representatives of American business houses in connection with the extension of trade, forwarded 351 replies to trade inquiries, compiled 95 voluntary trade reports and answered 46 special requests for trade information, all of which are at the disposal of the commerce department. When the record for work accomplished by the other consulates in China is taken into consideration, throwing the lime light on that splendid system of co-operation extolled by Judge Lobinger, it is no wonder that he brought tears to the eyes of those consular officials cognizant of these pathetic truths.

We looked around the grand banquet hall for another face. It was absent. We recalled that this $6,000 a year consul-general with twenty-five years of service behind him, in addition to his many other duties of making out invoices, passports, clearances and looking after American seamen and destitute citizens, with notarial duties and the avalanche of paper work and red tape which forms the daily grind of his office; omitting altogether his arduous executive labors on the consular body which directs the affairs of the international settlement; the calls upon his time to represent in a fitting manner his government at all kinds of international functions and to act as guide, host, and general entertainer to other first-class American officials who from time to time honor the port with a visit; is also the registrar of American property in Shanghai and its consular district. Over $30,000,000 worth of American property is registered in his office and during 1922 there were 92 deeds executed and 149 titles transferred, or the work of a good sized municipality at home.

Thinking of registration of property led us naturally to the recently created office of registrar of China trade act corporations for which the department of commerce has appropriated $29,000 a year to provide for the expected rush to take advantage of this legislation. We recalled that the registrar appointed to reside in China receives a salary of $7,500 a year in addition to travel expenses and the necessary staff. We also recalled that to date just two companies had registered under the new law. We also recalled that there are 461 companies registered under the Hongkong ordinances and we are informed that the extra cost of this registration to the British consular service is exactly $3,000 (Hongkong dollars), or the salary of a Chinese clerk and his assistants who handle the papers. Under the British system, the consul or consul-general acts as registrar, his duties being equivalent to those exercised by his American colleague in the registration of property. Recalling this feature of the day's work in the $6.000 a year consulate, it seemed to us that if the American government was really anxious to practice economy and bring down the burden of taxation, that one Chinese clerk or an American stenographer added to the consular staff might conceivably be sufficient to take care of the rush to register the new China trade act corporations.

We realized how difficult it would be for any federal official to invite attention in a public speech to these inconsistencies in the government service and our sympathies went out to a body of men upon whose whole-hearted co-operation depends to such a large extent the efficiency record of other departments but whose tongues are tied by the traditions of a service schooled to express most diplomatically their opinions on these matters. Co-operation, co-ordination and cohesion in all branches of the federal service are essential to the full attainment of our national aspirations in China, but frankly, we fail to see how it can be cheerfully given when the wheel-horses of the united services have their meager salaries pared down to where it is a struggle for them to exist decently,

while other departments more fortunate in securing appropriations, create high salaried sinecures and posts which not only duplicate the work of the consular officials but rely to a large extent upon them for assistance and success.

Public sentiment at home is crystallizing in favor of a sounder and more suitable recognition of the talent required to represent the nation adequately in foreign fields. If the United States is to be represented in consonance with its greatness, it must pay its representatives in other lands such salaries as will attract men of the desired capabilities and permit them to live befitting their station. Our diplomatic service has been filled in large part by men of wealth who were willing to pay out of their own pockets for the privilege of serving and were compensated by the prestige and social standing their positions gave them. The system shut out abler men from the service, and handed it over to social climbers whose principal ambition was to shine at some European court. As for the consular service, the door has also been closed to promotion above the $8,000 a year limit. It has been virtually out of the question for a man in the consular service however able he might be, to step into a highly responsible diplomatic post, or any other kind for that matter, unless he has the good fortune to get transferred into the more active and better paid service of the department of commerce, where he stands a chance of keeping himself before the public and working up a reputation that will land him in a big salaried job with some of the many great industrial and export concerns seeking heads of departments with a knowledge of foreign markets and merchandising. Rarely does the consular official ever get the opportunity of expressing his views freely before the business-men of the country. He stands, however, as the backbone of the entire system, even here in China, where only the interior department is unrepresented, and should receive consideration due to the importance of his work. It was highly gratifying to listen to a great American judge so eloquently plead for a greater measure of co-operation between the federal officials in China, but in the last analysis, this means a further load of work shouldered on to the consular officials, further co-operation on their part, to enable the other department officials to get greater publicity, increased appropriations and larger salaries. This is not co-operation; it is a rotten imposition upon men who see their salaries diminishing from year to year, while new sinecures and jobs are created to duplicate their work and serve as an excuse for wasting the public moneys. Under these conditions, or until the consular service is recognized and adequately remunerated, co-operation between American federal officials in the China service will be all one-sided. In discussing the bill for the diplomatic and consular service now before it, congress should give some thought to these truths and the arguments of Secretary Hughes to better the condition of the real representatives of the American government in foreign lands. Provide proper salaries, allowances and living quarters for the consular service, place them on a par with at least some of the more newly created office holders who duplicate their efforts, and then let us appeal for cooperation that will work both ways. This is our humble opinion about real American co-operation between federal officials in China.

G. B. R.

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Asiatic Machinery Markets

By W. H. Rastall

Chief of the Industrial Machinery Division of the United States Department of Commerce, Bureau of Foreign and Domestic Commerce

NOTWITHSTANDING the fact Japan, the best of the Asiatic markets for American machinery ranks only fourth among the markets of the world, it should be emphasized that the Asiatic group shows signs of rapidly increasing importance and deserves more attention than the present volume of business might suggest. All five of the leading Asiatic markets rank better than 13 among American machinery markets. Of total machinery exports the Asiatic markets took 7.4 per cent. in 1910, 6.8 per cent. in 1913, 22.9 per cent. in 1919, 18.5 per cent. in 1920, and 26.1 per cent. in 1921. In other words, the comparative importance of the Asiatic group, as expressed in percentages, expanded about three and one-half times in the last decade, and the value of American machinery absorbed by Asia rose from $3,800,000 in 1910 to $64,400,000 in 1921.

As contrasted with the markets of Europe which are contracting, the markets of Asia are showing most satisfactory expansion, and it would appear constructive sales effort would yield the best returns when applied to expanding markets. Most of the countries of Asia are densely populated and show indications of being capable of marked industrial development, as contrasted with markets in other parts of the world in territories that have developed more recently, where there is a lack of adequate population. South America, Australia, and other sections have their immigration problems, but with Asia it is more a matter of raising the standard of living and rapid progress is being made in this direction.

It is a mistake to think of Asia as the "unchanging East." Railways are being developed, shipping increases rapidly from year to year, mines are being opened, industries are being established, highways are being constructed, automobiles and trucks are being placed in service, and in a great many other ways the entire continent is showing sings of absorbing an everincreasing volume of mechanical equipment of great variety. In mapping out a sales program for the current year the foreign-sales manager should make amply allowance for these and many other factors.

Japan ranked 4, 4, 8, 10 among the world markets for American machinery in 1921, 1919, 1913 and 1910, repectively. For many years Japan has surprised the world by its industrial development. There is something remarkably consistent about the way in which Japan has developed, and the increase in the volume of machinery absorbed, whether measured in dollars or in the relative importance of this market. Japan is being industrialized. The standard of living for its people has risen rapidly during the last several decades. Thirty years ago it was a cheap country in which to live; it has become one of the most expensive in the world.

Country on Gold Basis

The country is on a gold basis and the exchange situation has not become a problem. On July 30, 1914, the exchange value of the yen was $0.499; on July 31, 1920, it was $0.515; and on December 1, 1922, it was $0.485. Probably the exchange will not get far from the par value, which is $0.4985.

American machinery rapidly is increasing in popularity in this market. In 1910 the United States supplied 20.1 per cent. of the machinery absorbed by Japan. In 1919 the share of the United States had increased to 75.4 per cent. but conditions then were abnormal. In 1921 our participation was 52.9 per cent. These figures seem to indicate that more business awaits the American manufacturer in this market if he will take the steps necessary to secure it. Even with this lower participation in the trade, the total volume has been so large as to represent a very remarkable increase in the American share, which has expanded from about $1,700,000 in 1910 to nearly $21,000,000 in 1921.

China in 1921, 1919, 1913, 1910 ranked 5, 7, 28, 15, respectively, among our machinery markets the volume having increased from about $642,000 in 1910 to more than $18,000,000 in 1921. It would be difficult to find a better record for expansion in both volume and rank. Chinese exchange always fluctuates very rapidly and widely, as the currency is practically on a strive basis and follows the silver-bullion market. The Shanghai tael on July 30, 1914, was worth $0.60; on July 31, 1920, it was worth $1.065; and on December 1, 1922, $0.713. In the face of disturbed political conditions, unsatisfactory currency systems, inadequate transportation, and a number of other disturbing factors, trade in China expands rapidly in many directions and industrial activity shows rapid

development. Moreover, American equipment is becoming increasingly popular in China. Our share of the total machinery trade of that country was 5.8 per cent. in 1911, 8.3 per cent. in 1914, 30.4 per cent. in 1918, and 54.1 per cent. in 1920.

British India ranked 8, 15, 22, 19 among our machinery markets in 1921, 1919, 1913 and 1910, the volume of American machinery absorbed having increased from $500,000 in 1910 to $10,700,000 in 1921. Exchange in India has been fluctuating widely. On July 30, 1914, the value of the rupee was about 32 cents ; on July 31, 1920, it was 37.25 cents ; and on December 1, 1922, it was 30.03 cents. The currency fast is approaching stability.

The industrialization of India has become the avowed policy of both the government and the public. The imports of machinery are expanding rapidly, and during recent years the American participation in this trade has shown a marked increase. During the fiscal year 1913-14 the total imports of machinery into India were valued at £6,000,000, of which the United States furnished 1.8 per cent. During the war imports fell off, but American participation increased rapidly. During the year 1919-20, when the forces of reconstruction had begun to operate, the imports were £8,600,000, of which the American share was 29.3 per cent. During the year 1920-21 the machinery imports were £25,300,000, and although the volume from the United States increased, the percentage fell to 13.7 per cent.

India may be expected to show rapid development along all industrial lines that its population and resources can support. In spite of the fact that there is a large volume of native capital available, it should be noted that British capital flowing into the country at an ever-increasing rate, and the markets of India may be expected to absorb increasing volumes of industrial machinery from now on. Unfortunately the machinery users of India have a very inadequate knowledge of the types of machinery produced in the United States and the uses to which they may be put. India is a large market that deserves careful sales work of a character suited to its development.

Among the markets for American machinery the Philippines ranked 11, 8, 11, 18, respectively, in 1921, 1919, 1913, and 1910, and the value of American machinery absorbed increased from $500,000 in 1910 to $5,500,000 in 1921. This represented most of the machinery taken by the archipelago, the American share of the total vahing expanded from 73.1 per cent. in 1915 to 97.3 per cent. in 1920. In fact, American influence in this territory is so strong as to make it almost part of the domestic field.

The exchange situation is independent of that of Europe. On July 30, 1914, the Philippine peso was worth 49.9 censs ; on July 31, 1920, 47.25 cents ; and on December 1, 1922, 48.2 cents. Currency has reached reasonable stability.

The sales manager's problem in this territory is one of development, which has been rapid since American occupation. In this market one will find endless problems, not the least of which is the comparative scarcity of labor. But, on the other hand, the sugar industry has been expanding rapidly and in the years to come will probably show further development. In many other directions this market shows great possibilities.

In 1921, 1919, 1913, and 1910, respectively the Netherlands East Indies ranked 13, 17, 25, 27 among our machinery markets, value of American machinery exports expanding from $84,000 in 1910 to $5,000,000 in 1921. This has been due largely to the fact American machinery has become better known in the country since the beginning of the European war. Circumstances connected with the war served to introduce our equipment there, and since then American machinery has been popular. Satisfactory development of this market, however, depends upon careful sales work.

Excluding machinery for sugar factories, America's share in this trade was less than 2 per cent. up to 1914. At that time, however, important progress began and by 1919 (the last year for which data are available), American participation was 34.5 per cent. Of the machinery for sugar factories the United States supplied less than 1 per cent. up to 1915, but its share increased to 36.8 per cent. by 1918, after which it fell off rapidly to 4.1 per cent. in 1920.

This market offers a difficult sales problem, but inasmuch as it absorbs more than $5,000,000 worth of our machinery a year, and as conditions indicate a larger participation might be developed, it would appear the trade deserves the necessary attention. Conditions in this market are obviously related to those in the Netherlands, and the two territories should be considered jointly. Exchange is on a reasonably satisfactory basis. On July 30, 1914, the guilder was worth 40.9 cents ; on July 31, 1920, it was worth 34.4 cents ; and on December 1, 1922, it was worth 39.6 cents.

Business in this market has been confronted with serious problems during recent years. Sugar is one of the most important products, and the reaction of the sugar market has been felt seriously, but as the price of tdis commodity now approximates 4 cents, it would appear the industry is again on a profitable basis. The fluctuations in the rubber market have also seriously affected this archipelago, but in this respect, also conditions have improved greatly. Java is one of the garden spots of the world, and it would appear that reconstruction has now advanced to such a point that important development may be expected as rapidly on the present favorable business conditions enable these interests to overcome the difficulties resulting from the recent experiences.

Conditions in the smaller Asiatic markets, such as the Federated Malay States, Ceylon, Siam, and Indo-China, are to a greater or less extent reflected by those indicated above, and it will be noted that the conditions in the entire territory encourage the expection of important developments in the near future. No general rule can be laid down that will apply to the marketing of all kinds of machinery, and obviously it would be folly to expect these markets to employ the more specialized types that have been developed for use in the United States. On the other hand, there is a definite opportunity to expand the sales of those other types that are suitable for use in these countries.

The machinery markets of Asia are so important and the extension of American participation there during recent years has been so great that a special report on this subject has been prepared by this bureau and will be ready for distribution in the near future. The subject has been treated rather exhaustively, the report totaling 332 pages, well supplied with illustrations, charts, diagrams, and several maps that have been specially prepared to indicate the size and importance of these markets. The volume of the trade of each country, the kinds of machinery absorbed, the nature of industrial development needed, and the methods by which the business should be secured and handled have been treated with very great care. This report is entitled "Asiatic Markets for Industrial Machinery" and can be secured from the superintendent of documents, government printing office, Washington.

* * *

The Development of Engineering in China

Industrial *versus* Civil Engineering

By Lawrence Impey, Assoc. M. Inst., Municipal and County Engineers

DURING the last decade the development of engineering in China has made remarkable progress, as was almost inevitable in a country but newly opened to Western ideas and still struggling against the reactionary impulses of the older generation of its citizens. There is always a danger, however, that a people suddenly awakened to development along fresh lines may adopt a program impulsively and without due reflection as to whither it is leading them, until they find themselves committed to a course which at first was far from their thoughts or desires.

As an illustration, we cannot do better than regard the situation in Europe during and after the war. The first causes of the

cataclysm may be traced back to the early years of the nineteenth century, when England, from being an agricultural population, became to a large extent industrialised, and transferred large masses of her labor from the land to the workshop and the factory. This industrial productivity was imitated on the continent, by France and Germany in particular, with the result that an immense competition for world markets for their goods soon developed. This was due to the fact that none of these countries was content to manufacture for consumption only, but drew more and more of its agricultural population to the cities in the struggle for export trade.

The dearth of labor for food production was not noticeable to any great extent in France and Germany until the latter years of the nineteenth century, but in England it proved to be a different matter altogether, though the full danger was not realized until the closing years of the great war. From year to year the government returns showed a steady increase in the export of manufactured goods, and a corresponding increase in imported food supplies, as the transfer of labor from the farm to the slum rendered Great Britain increasingly unable to cope with her own demand for agricultural produce. In no country in Europe was the danger realized, and the system of national credits was extended again and again under the pressure of industrial necessity.

Paper currency was brought into existence and negotiated in larger and larger quantities in order to meet various emergencies, without any pause for reflection that while gold was always good at par, a paper money had no real value beyond the fact that it was a 'promise to pay' on behalf of some bank or nation, and was only financially stable up to the point at which the faith of the world market in the said 'promise' began to waver. The over productivity of the three or four great manufacturing countries of the world led them to go further and further afield in search of fresh markets which would consume their goods, and this was the first cause of the opening up of China and Japan, and their subsequent invasion by merchants and missionaries.

The competition for export trade, which grew more keen year by year as the United States of America began to absorb her share, which proved to be an increasingly large one, culminated in the world war of 1914, a war which the congestion of the world markets and the growing unrest amongst the laboring population had rendered almost inevitable.

The outbreak of the war quickly forced upon the British a realization of the fact that they were no longer a self-supporting nation, and that in these days of modern warfare it was more particularly dangerous for an island population to be dependant upon exterior sources for its food supply. The end of the war taught them the fresh lesson that national credits may prove to be but a broken reed in times of stress, for it slowly came to be realized that the various debtor nations had nothing in which to pay their debts but paper 'promises to pay,' which were of very doubtful value, or goods from their factories, with which the market was already overstocked.

It is true that practically all countries have some export of either raw or manufactured stuffs which is a necessity to some other people in the world, but this is, of course, but a minor item in the development of their trade under the present system. It seems conceivable, however, that this financial and commercial collapse in Europe, which may not improbably spread to the United States of America, will force upon the nations of the occident the choice between a return to agricultural production and industries which are chiefly for home consumption, or a relapse into the barbarism which has engulfed so many civilizations in the past.

Japan has already begun to industrialise her population, whether wisely or not, time alone will show, and the trend of events seem to be urging China along a similar course. It is this possible development in China which it is the purpose of this article to consider, in the hope that some of the attendant dangers may thereby come to be realized and avoided. China in the past was undoubtedly self-supporting, and its population chiefly agricultural, though it had a number of industries developing at the same time in various distinct centres, so that sweated industrialism, as in Europe and America, was entirely unknown. The chief ills which have befallen China in historic times have been due not to lack of industries, but rather to warfare and famines, of which she would appear to have had more than her share.

The curse of warfare has been due chiefly to the provincial spirit as opposed to the feeling of nationality, which has existed for centuries, and led to endless strife between military despots in the various provinces of China, and which even now is strikingly exemplified by the internecine warfare of north and south, and the rivalries of Sun Yat-sen, Wu Pei-fu, Chang Tso-lin, and many others.

In England, in Italy, in Germany, intercommunication proved the remedy for similar ills, by bringing the people of the various districts together and enabling them to realize their national unity and that the existence of the corporate whole depended on the successful co-operation of the areas comprising it. This mutual understanding is needed in the China of to-day, and the key to it lies in the improvement of means of communication, which at the same time will prove to be the solution of the ever present danger of famine, which in the past has so often devastated the country. Floods or drought have been the cause of most famines in the East, and these can be dealt with in a variety of ways by the science of engineering.

River conservancy, which besides straightening and deepening the river channels to ensure a clear flow, also includes the construction of the necessary dykes to act as retaining walls in the event of unusual flood water, is but one of its branches. The construction of dams and reservoirs in the mountainous districts in order to ensure a sufficient supply of water in the dry season, together with the designing of schemes of irrigation to remedy the drought on the plains below, is another, and one which is particularly applicable to northern China and the provinces of the interior. Afforestation, which is badly needed in certain provinces, has a decided effect on the rainfall and therefore on the crops, while it also has an almost unlimited commercial value, though until recent years the necessity of replanting forests has hardly been appreciated even in the countries of the west, where it has been of the most vital urgency.

Roads and railways, perhaps the most noticeable product of the engineer, will serve a purpose in famine prevention in China which has hardly yet been realized, for it is an undoubted fact that a famine in this country is usually confined to some portion of a province, while provinces to the north or south of the afflicted area may have an abundance of food stuffs, which they are unable to supply owing to lack of transportation and intercommunication.

Finally we come to the problem of sanitation, a problem which has been more or less successfully solved in other countries by scientific drainage and sewage work, and which in China has not yet received the slightest consideration, except in a few of the foreign concession in the larger treaty ports. As opposed to these constructive branches of engineering, which are an end in themselves, we have engineering as applied to the development of industrialism, and which we have studied in its results in other countries. Engineering in all its branches is a science which should be applied to the benefit of humanity, and it is only when it is devoted to the construction of war machines bringing devastation and death, or the over development of industrial production, with its concomitants of slums, sweating, and eventual national paralysis, that it may be said to have been perverted and misused.

The Chinese have been an agricultural people in the past, and they would be well advised to remember that fact, for though they possess vast natural resources which would enable them to enter into industrial competition with the nations of the west, it would seem doubtful whether it would be in their best interests to do so.

At present they do not produce a large amount of foodstuffs beyond their own needs, and if they decide to devote a large proportion of their population to manufacturing industries, their food supplies are certain to be penalised. There is a vast field open to them in improving their internal conditions, and in stimulating

those industries which will supply articles for home consumption, and before going beyond these and entering into a competition with other nations for a world market for those manufactures which are already handled abroad, the Chinese of the rising generation would do well to devote some thought to the economic situation.

Most of the countries of the world are becoming producer countries from the manufacturing point of view, and it is becoming increasingly difficult to find a market for goods in huge quantities under the present financial conditions, while there is no indication that this difficulty will lessen very materially in the future. Therefore it would seem that the development of engineering in China should take the constructive line which has been suggested above, and which will lead to increased prosperity on normal lines, rather than aid in the expanding of a policy of industrialism, which if developed too far, cannot but threaten to bring disaster in its train.

* * *

Electrical Development in China

By E. L. Clark

WITH over 300,000 k.w. of installed capacity in China, electrical development can be said to have passed the experimental stage and entered on the stage where refinement in design, more accurate calculations for transmission and setter adaptation of machinery for the purpose for which it is designed, has been ushered in. We find in China a tremendous contrast between the 100,000 k.w. generator station of the Shanghai municipal council which operates under as favorable conditions as almost any city power plant in the world, which carries a loadfactor of around 45 per cent. and which has generating units of 22,000 KVA—with the little power station in central China which has perhaps 300 k.w. so sadly overloaded by the demand for modern power, that the operator frankly admits the voltage regulation is as poor as 30 per cent. This plant would fail half of its customers if anything were to happen to one of the units.

The growth in demand for electricity has been very rapid in the last few years, the demand now reaching many of the small cities and villages in China. Up to 1915 perhaps one to five plants were added per year, 1916 nine to ten plants were added while in 1921 a conservative estimate would indicate that twenty or twenty-five new plants were developed exclusive of small units less than 100 k.w. operated by gas or steam. Paralled with this electrical development or perhaps causing it, has come the market for electrical goods in the industries. With a population of 400,000,000 people using practically no cloth but cotton, but even now importing less than 5 per cent. of the probable demand for thread, the demand for modern production and the opportunity for profits in modern mills has more than any other industry, attracted both Chinese and foreign capital. Even as late as 1900 only fifteen or twenty modern mills were in operation, the increase was gradual up to 1918, when perhaps forty-five mills had a combined installation of 1,200,000 spindles. Taking advantage of the exchange situation during the last two years, the Chinese have thrown capital into this industry so that at the beginning of 1922 there had been over two and a half million spindles.

The demand for such power has thrown tremendous problems on to the central station plants and even such an efficient and huge plant as the Shanghai municipal council has had very great difficulty in keeping up with the demand.

An analysis of the power stations in China makes three problems stand out most strikingly: (1) Adequate capital investment, (2) proper operating conditions in the generation plant, and (3) satisfactory distribution to the customers.

The question of capital involves the interest of men of means in this type of industry. It has been hard for the business man of any particular city to grasp the requirements of the power plant demand for power, but also reserve for the rapid growth which would soon follow. Consequently there have been many failures and many more plants put up which are so inadequately supplied with equipment or generating capacity as to be of little real service to the community aside perhaps from merely lighting the house and streets.

The engineer, of course, depends on capital of efficient work but for the purpose of this paper, we would prefer to consider the technical engineering problems rather than problems of finance.

Considering then the equipment actually in use in China in the power stations, an analysis of the stations bring out the second problem, namely, that many of the smaller plants are working with very inadequate equipment.

In the following analysis we have committed altogether the Shanghai municipal council and the French power plant in Shanghai, Canton, Hongkong, Tientsin and the principal cities in Manchuria are included. Japanese controlled cities excepted.

The record, taken from as many sources as possible, covers 205 stations on many of which the reports are of course inadequate or old. The figures are only those of actual record. As a matter of fact there may be in China from 10 to 20 per cent. more power than the summary shows.

Of the 205 stations 84 are under 100 k.w., 81 are from 100 to 1.000 and 41 are over 1,000. The total capacity of these stations is 165,000 k.w. which, if the Shanghai power of 120,000 k.w. be added, gives a total of 286,000 k.w. for China. By far the largest part of the power goes into lighting with the result that the lamps per k.w. varies from 40, the larger in the smaller towns to 20 in the industrial centres. An estimate for all China, including Shanghai, would be 4,500,000 sockets.

In the 205 stations machinery from all parts of the world has been installed with the result that a good many different voltages and frequencies have been used. 75 cycles, even, existed for a time in the south but has now been superceded 50 cycles has the preference if Shanghai is included. Exclusive of Shanghai the following table gives the results:—

Frequency.	*Number.*	*k.w.*
50-cycles	32	81.750
60-cycles	54	65.090
Direct current	25	4.000
Ooc. frequency	2	10.000
Misc. frequency	—	—
Unknown	92	15.000
	205	165.840

Of the 92 plants in the last class an estimate may give 3/1 to 50 cycle, 3/1 to 60 cycle and 3/1 to D.C. many being gas engine sets used in small towns back in the country.

The variety of equipment is shown even more strikingly in the voltages at which power is generated. There are 350,240 plants generating at between 2,200 and 2,300 volts, 80,210 plants have generating voltages of 3,000 to 3,500 volts. There are also one or two plants each at 6,000 volts, 5,200 volts and 4,400 volts, besides a large number of small plants which generate the distribution voltages of 440,220 or even 110. The common distribution voltages are 110-v. and 220-v. A few of the cities copy Shanghai in having 350/200 volts. There are, however, any number of 000 voltages, such as, 32-volts, 100-volts, 380-volts, 440-volts, etc. On the D.C. lines 110/220 have preference. In some of the industrial plants, however, the distribution is at 220/440 volts.

However, the station voltage rating of equipment means very little. The important point is the voltage regulation. Proper regulation is the most serious problems which power users experience, as may be shown later in the effect on motors, lamps, etc. As already mentioned one man considered himself lucky if he got 30 per cent. voltage regulation. As a matter of fact, consumers have to face voltage anywhere from normal down to 60 per cent. of rated voltage.

The best regulation reported is 30 per cent. Out of 25 reports received, 8 reported better than 10 per cent. four from 10 per cent. to 15 per cent. and five no better than 20 per cent.

No general conclusions can be drawn in regard to types of transformers used, although, of course, most primary transformers are 3 phase and, as the majority of power goes for lighting, almost all the secondary transformers are the pole type. Lighting arresters are conspicuous by their absence. Outside of the large plants about the only arresters used are the multicap on compressed chamber type. One of the big contributions which the association could make would be to study the conditions in China in regard to electrical storms so as to be able to advise what the power stations in different localities should be prepared to meet.

Except in the large cities, street lighting is more a matter of impression than utility as the average size of lamp used is 16 to 25-c.p. the lamp are usually strung at rather long intervals with only tin reflectors if any reflectors at all.

Three-fourth of the plants report 150 to 160-lbs. steam pressure, one reports 200 and one as high as 250-lbs., there are a great number who report under 100-lbs. pressure. With plants of this type, approximately one-half the condensers are of the jet type and one-half of the water tube type. The result is that only a few read 28-in. vacuum, the majority acknowledge 27-in. or less. This question of maintaining high steam pressure and low vacuum depends a great deal on the type of operators which the plants can employ and on the care with which the equipment is maintained. A spendid service could be rendered by issuing Chinese instructions corresponding to the standardization rules showing how power plants can be tested and what conditions are necessary for efficient operation. Only a small additional attention in regard to use of measuring instruments, handling of coal and care of the boiler, fires, etc., would be necessary to make a difference between success and failure on the part of a good many plants.

Inadequate equipment and poor regulation affects both the power plant and the consumer in a serious way—from the viewpoint of the power plant, in serious loss of revenue, if the voltage drop is even a small percentage of the rated value. The following figures have been taken from experience with actual operating plants:—

If there are 10,000 lamps connected, the anticipated revenue per year would be $48,000, the loss in revenue for the conditions mentioned below would be $1,440. These figures are based on using 40-watt lamps two hours a day for 300 days a year and the voltage impressed across the terminals is normal for half the time and 4 per cent. below normal for the remainder of the time. The cost of power consumed was 20 cents Mex. per k.w. hour.

Looking at it from the viewpoint of the consumer, merely a 5 per cent. drop in voltage means a big loss in power received and efficiency of lamps. For example on 110 volts theoretical circuit supplied with 110 volt lamps, the voltage is allowed to drop to 105 volts the candle power from the lamp will drop to 85 per cent. of normal. The wattage for candle power will be nearly 10 per cent. higher, on the other hand, the lamps will last almost twice as long. No wonder one of the salesmen reported from a certain city that the lamp business had decreased because the voltage was low, the city regulations required that 110 volt lamps be supplied. His comment was "lamps no burn out quick." When it is common to fine 10 per cent. drop in voltage not 5 per cent., the seriousness of the situation cannot be overemphasized from the viewpoint of actual loss in cash value to the power stations and the consumers.

That the above rate of twenty cents Mex. per k.w. hour is fairly representative may be shown by the average charges for power in China. The rate for lighting is quite uniform throughout the country, it being based on a charge per month per candle power. The average is $1.20 for 16 c.p. or 20 watt lamps. The average varies from $0.90 for 16 c.p., to $1.30. The power rate varies over very wide limits, the minimum being five cents per k.w. hour, the average is approximately 25 cents per k.w. hour.

The effect on lamps has been emphasized because outside of the larger cities, most of the power goes for lighting. The effect on other electrical equipment, however, is not less serious as the heating effect varies the square of the current. The motor which is carrying full load on normal voltage will very rapidly overheat and burn out if the voltage is allowed to drop below normal. A 10 per cent. drop in voltage means roughly a 10 per cent. increase in current with a resultant 20 per cent. increase in heating. If than the motor is required to carry full load at a voltage 15 per cent. below normal the temperature rise may be enough to cause serious trouble if not a burn out. Many of the complaints for failure of machinery are due to no other cause than bad voltage regulation, and yet, unless the operator appreciates the situation, the blame falls back on the manufacturer. The result is economic loss to all parties for the following reasons:—

The manufacturer to protect himself must give a motor of larger capacity than is actually required with resultant increase of price to the customer. The customer is running a motor at one-half to three-quarters load instead of normal load most of the time resulting in lower efficiency and the use of more power. These remarks apply to any type of motor. The situation is even more serious with induction motors, because a drop in voltage on an induction motor means much lower factor. A lower power factor results in increase of current, heating effect, loss of power, even worse regulation and difficulty in handling the generator equipment. A drop in voltage at the consumer's terminal, therefore, means a loss all the way back to the power plant (1) in the light and motors, due to increased current or poor power factor, (2) in the transmission and transformers due to the additional current which must be carried, and (3) in the generating station due not only to the additional current but to the difficult problem of voltage regulation when the power factor is bad. The loss increases approximately as the square of the current.

In looking over the field, there is great encouragement in the demand which is being made for electricity in China and the rapid growth in the number of power plants. On the other hand, this growth brings serious problems, the principal ones being (1) adequate capacity of the plants, (2) suitable equipment and design of the plants and (3) proper supply to the customers. If any one point should be most strongly emphasized during this stage, it would be that the power plant operators and customers must insist on good voltage regulation, as this is the most important element and the key to successful and efficient power plant operation. If the facts could only be presented showing the actual economic loss due to even a 5 per cent. drop in voltage, we are sure that much more attention would be paid this important phase of power plant operation.

The detailed methods of maintaining voltage through voltage regulators, properly designed distribution system, intelligent station operating, etc., from a separate problem in each case.

The association of Chinese and American engineers can contribute much by (1) emphasizing the need of this study and (2) supplying information to or actually assisting in testing power plants which face this situation.

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Construction Costs in China

A Review of "The Chinese Railway System" by H. Stringer, B.A., Cantab., A.M.I.C.E., Resident Engineer, Peking-Mukden Railway. Published by Kelly & Walsh, Limited.

LIKE most technical writers, the author is not always accurate in explaining the political side of Chinese railway contracts and concessions but is more interesting in his handling of administrative, operating and construction data. In this respect the book is a welcome addition to technical literature and of immense value to engineers in estimating costs in China. The book gives a general résume of the history of the railways, their statistics and a list of railway loans, etc., but it is in the chapters on the case for machinery on railway construction in China, the

use of reinforced concrete and construction data that its real value rests.

There is some exceedingly interesting information in the chapter devoted to the economics of Chinese railways which treats of native transport, roads, and average costs of transportation. For instance, the following data is given on the costs of the various modes of transport which varies in a country where labor increases in cost from north to south (wages in the Yangtze region being about 50 per cent. and in Canton 100 per cent. higher than in North China).

Type	Cost per mile	Remarks
Cart	10 to 20 cts. (2d. to 4d.) per ton mile.	Max. load 1½ ton. English cart 25 cwt. cost 7½d. per ton mile.
Water	½ cent to 1 cent (0.1d. to 0.2d.) per ton mile	Sailing boats up to 200 tons. An extra of 4d. per ton for loading is charged.
Wheel-Barrow...	10 cts. to 30 cts. (2d. to 6d.)	Max. load 800-lbs.
Mule	15 cents (3d.)	Max. load 200 to 270-lbs.
Railway	1 cent (0.2d.)	Cost to government.

Costs per mile of metalled and unmetalled roads, cost of railway construction, motor traction, and other interesting data on traffic costs and charges are given. In the chapter on machinery on railway construction are found estimates of costs to run excavating, pile driving, stone breaking and quarrying, concrete mixing and minor contractor's machinery. The chapter on reinforced concrete also gives useful cost data and estimates for Chinese railway work and the memorandum on earthwork is also of exceptional value to contractors in preparing estimates. This data makes the book a contractor's manual for Chinese construction work. As it was printed by order of the board of communications of the Chinese government, it may be taken as an official presentation of data that should be in the hands of every financier and engineer interested in the management, operation and construction of railways in China.

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Travels of a Consular Officer in Eastern Tibet

A History of the Relations Between China, Tibet and India by Eric Teichman, C.I.E., B.A. (Cantab.) of His Brittanic Majesty's Consular Service in China, Author of "Travels of a Consular Officer in N.W. China," Published by the Cambridge University Prsss, London. 25s. net

UNDOUBTEDLY one of the most valuable contributions to knowledge about this remote part of China. Although the highly illustrated book is devoted largely to descriptions of the places visited by the author on an official tour beginning at Tachienlu and covering the Eastern Tibetan country as far as Chamdo on the west, its main value lies in the few chapters giving the political history of Tibet during the past two decades. Much that has been obscure to even the intelligent observer in China is clarified by the presentation of the facts surrounding Chinese, British and Tibetan policies in this mysterious land.

The questions at issue are comparatively simple to state, if they are not easy of solution. Briefly, Tibet seeks, if not complete independence, autonomy and freedom from interference in her internal affairs on the part of China, India, or other power, and would extend her boundaries to embrace all those parts of high Asia inhabited by peoples of Tibetan race. The Tibetans base their claim to manage their own affairs without Chinese interference on the history of their country as an autonomous state from the earliest days, and further argue that on the disappearance of their nominal overlords, the Manchu emperors, at the time of the Chinese revolution in 1911, they became, either entirely independent, or equal partners in the new commonwealth with the Chinese themselves and other constituent elements of the former Manchu empire.

This book has no official imprimatur of any kind. No secrets are made public, nor, so far as the writer is aware, are there any to divulge. All that has been done is to piece the various items of information together to make a consecutive story, which will, it is hoped, do something towards dispelling the fog of suspeicion and misunderstanding which is apt to enshroud the Tibetan question.

The writer lived too long in China not to be imbued with regard for the Chinese and admiration of their many outstanding qualities. At the same time he cannot avoid strong feelings of sympathy with the Tibetans in their gallant struggle for autonomy and regret that the Chinese should in this case have placed themselves so much in the wrong.

The book gives the inside facts surrounding a war for the subjugation of a free and independent people waged with great ferocity by China during the progress of the greater world conflict in Europe, a war that was only terminated in 1918 by the mediation of the British consular agent stationed in western China. The truce was only just effected in time to prevent the Tibetan advance towards Tachienlu from where it would have been difficult to dislodge them. Between the lines we get a glimpse of British activities in the far off mysterious corners of Asia where one white man braved the dangers of travel amongst wild, lawless tribes in order to bring about a peaceful solution to problems, which, if left to solve themselves in the traditional Chinese way, would once more involve Great Britain in another military expedition into Tibet in order to preserve the peace and security of India. As a record of service, the book is of greater value than the record of places visited.

The Bolsheviki in China

From "The Balance Sheet of Sovietism" by Boris L. Brasol. Published by Duffield & Co.

THE following extract from one of the recent books on the Soviet machine should be most interesting to Shanghai readers:—

"When Urin, *alias* Dzevaltvosky, proceeded to China in the rôle of Soviet ambassador, he carried in his luggage a bag containing 3 poods and 22 pounds of gems and precious stones, which were later exchanged for Chinese dollars and spent for propaganda.

"The Bolshevist scheme of the Red East is an adroit plan in which even minor details of the work have been discussed at length and scrupulously weighed. Its general outline, however, is based upon the plain fact of the discontent among the masses inhabitating the Asiatic continent. This is the great premise from which the deduction is drawn that subconscious fermentation among the Eastern peoples must be used *ad majorem Marxi gloriam*. To this end, all means are acceptable, all methods should be tried, all destructive forces set in motion.

"As a typical example of Soviet 'achievements,' the Far Eastern communist organization may be mentioned. Chita, the capital of the transbaikal region, was made the general headquarters for the Eastern Asiatic zone, comprising China, Japan, Korea, and Eastern Siberia. China is subdivided into four belts, with Peking, Tientsin, Canton and Shanghai, serving as communicating centres. Each of them has business ramifications of its own, subordinate to the local Soviet chiefs. Thus, the Shanghai organization, which probably is the strongest among the Chinese groups, works through the following subsidiaries :—

(*a*) The Chinese labor party, Gun-Dan-Koui, which disposes of considerable funds. Its members are conducting propaganda mainly among the army units. It also is engaged in buying munitions and supplies for rebel soldiers. This party publishes in Shanghai two newspapers and one underground organ, *Jan-Bao*.
(*b*) The Chinese Students' Federation
(*c*) The Chinese Labor Union
(*d*) The Korean National Organization
(*e*) The Zionist Group
(*f*) The Esperanto
(*g*) A special committee which prints *The Shanghai Life*.

"Propaganda, purchase of munitions, and espionage, are the three main lines of work in which the Shanghai communist centre is engaged."

The Oriental Development Loan

A TWENTY million dollar loan for the development of Korea guaranteed by the imperial Japanese government has been floated in the United States. Thus ends the campaign to obstruct Japanese-American co-operation for the development of enterprises in Korea and Manchuria, a step which, if followed up, will do more to preserve the peace of the Far East and assure the integrity of China than all the conventions, gentleman's understandings and discussions over the open door principle that clutter the reports of proceedings of international conferences. The mere fact that American capital is co-operating with Japan for the development of industries, mines, and agriculture in Korea, is a sign that an end has come to the long-drawn-out attempt on the part of Korean independence leaders to involve the United States in their cause, it also indicates that whatever may be the government's attitude, our bankers are willing to take a chance with Japan in developing the resources of Manchuria.

Office Building of the Oriental Development Company at Seoul

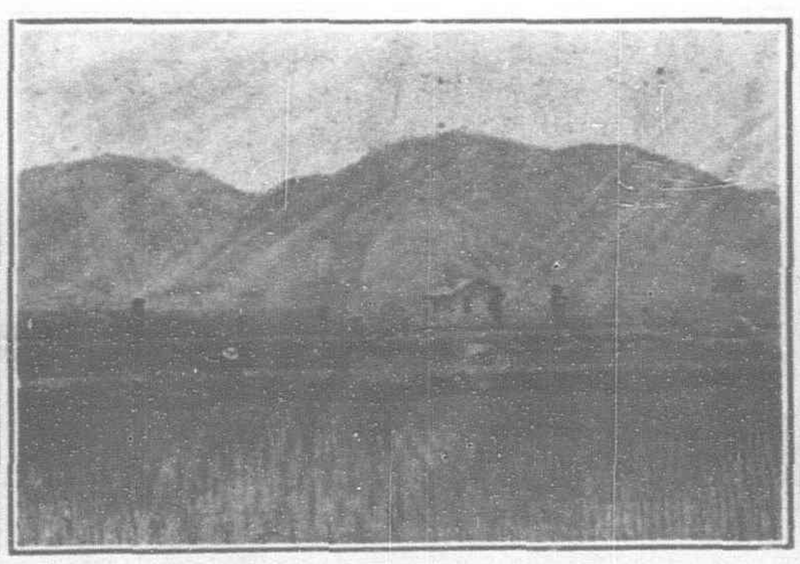
The keenest competition existed amongst international bankers for handling this loan, which was finally placed on the New York market on March 26 by the National City Bank. The bonds are debentures of the Oriental Development Company, Ltd., bearing six per cent., sold at 92 and maturing in 1953. Both interest and principal are guaranteed by the Japanese government and the proceeds of the loan are to be employed for agricultural development in Korea, though some of the money will be used in Japan and Manchuria.

It is now easy to read between the lines and understand more clearly the motives behind the recent cancellation of the Lansing-Ishii agreement, when it is understood that simultaneous with this, the Oriental Development Company, guaranteed by its government, was carrying on negotiations in New York for a large loan which might be employed in part for the development of Manchuria. With the acknowledgement on the part of Japan that she holds no special interests in Manchuria which conflict with the doctrine of the open door, there was no longer any legitimate reason why American financiers should decline to co-operate with Japan in the development of its resources. Although the Chinese may declaim against this loan as being inimical to their interests, common sense will tell us that the mere fact that American capital is co-operating with a Japanese company, is the surest guarantee that Chinese sovereignty will be upheld and the only guarantee for many years to come that American capital invested in that region will be adequately protected.

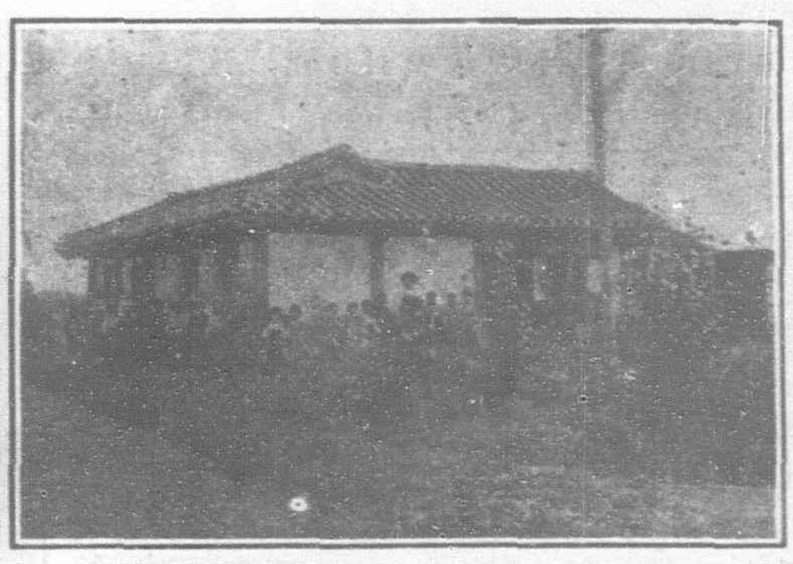
The Oriental Development Company, Ltd., is what its name indicates, an institution originally created for general development work in Korea, subsequently extending its scope of operations to other countries. When Japan undertook the task of developing Korea its government followed the precedent created by Great Britain and organized a semi-official chartered company to carry out the work. The Oriental Development Company, Ltd., was established in December, 1908, with a capital of Y.10,000,000, of which Y.3,000,000 was taken up by the government, its statutes providing rigid official supervision over its operation. The government furthermore furnished a subsidy of Y.300,000 for each of the first eight years, which is to be repaid out of excess profits when dividends exceed ten per cent.

The company started work early in 1909, not long before the formal incorporation of Korea in the Japanese empire, an event which doubtless accelerated the company's progress. The program of the undertaking was largely that of a bank making advances to settlers, to groups of farmers and on produce on the way to market.

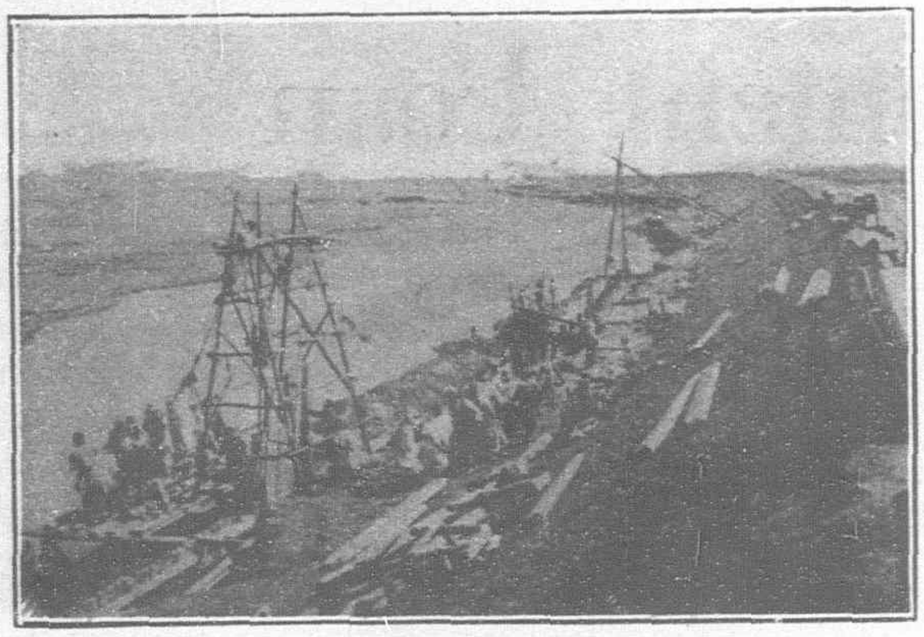
Ploughing by Native Farmers on Lands of the O.D.C.



Rice Cultivation by Japanese Immigrants introduced by the O.D.C.



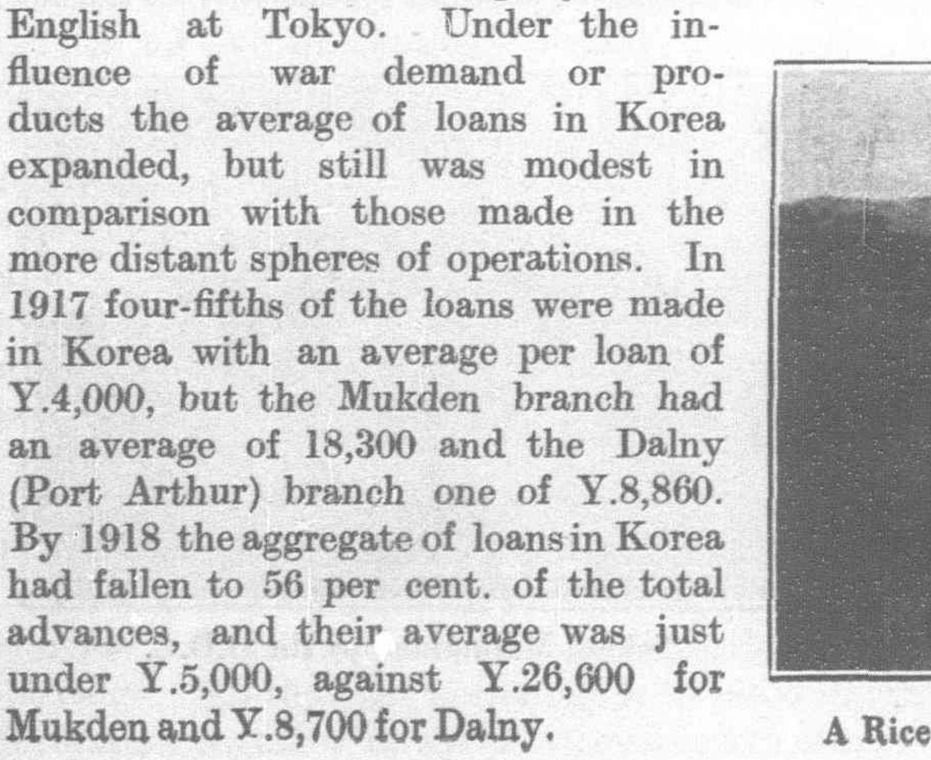
School Maintained by the O.D.C.



Building Flood Protection Embankment in Korea by the O.D.C.

and on the security of shares and debentures of companies engaged in dealing with emigrants, and in development work. Up to 1916, when the company confined its operations to Korea, the average amount of the loans made was small, and, indeed, had a declining tendency, the average falling from Y.5,835 in 1921 to Y.2,803 four years later.

Then came a revolutionary change in the scope of the Oriental Development Company, for in 1917 the statutes were revised to permit operations in foreign countries. Branches were opened at Mukden and Dairen in that year; in 1919 Kharbin and Tsingtao (formerly German) saw branches established. The company contemplates, if it has not already done so, the establishment of branches in some of the South Sea islands and in New York. The Philippines, Sumatra, Java, Borneo and even New Guinea are included in its potential sphere of operations. A curious fact emerges from a record of the company's achievements published in English at Tokyo. Under the influence of war demand or products the average of loans in Korea expanded, but still was modest in comparison with those made in the more distant spheres of operations. In 1917 four-fifths of the loans were made in Korea with an average per loan of Y.4,000, but the Mukden branch had an average of 18,300 and the Dalny (Port Arthur) branch one of Y.8,860. By 1918 the aggregate of loans in Korea had fallen to 56 per cent. of the total advances, and their average was just under Y.5,000, against Y.26,600 for Mukden and Y.8,700 for Dalny.



Horticulture Introduced by the O.D.C. at Tokuson

All such loans were repayable by instalments extending over various terms of years—in the case of produce within one year. Loans could also be made on real property, railways and mining concessions, to public corporations and industrial associations, and on the security of shares and debentures of companies engaged in dealing with emigrants, and in development work. Up to 1916, when the company confined its operations to Korea, the average amount of the loans made was small, and, indeed, had a declining tendency, the average falling from Y.5,835 in 1921 to Y.2,803 four years later.

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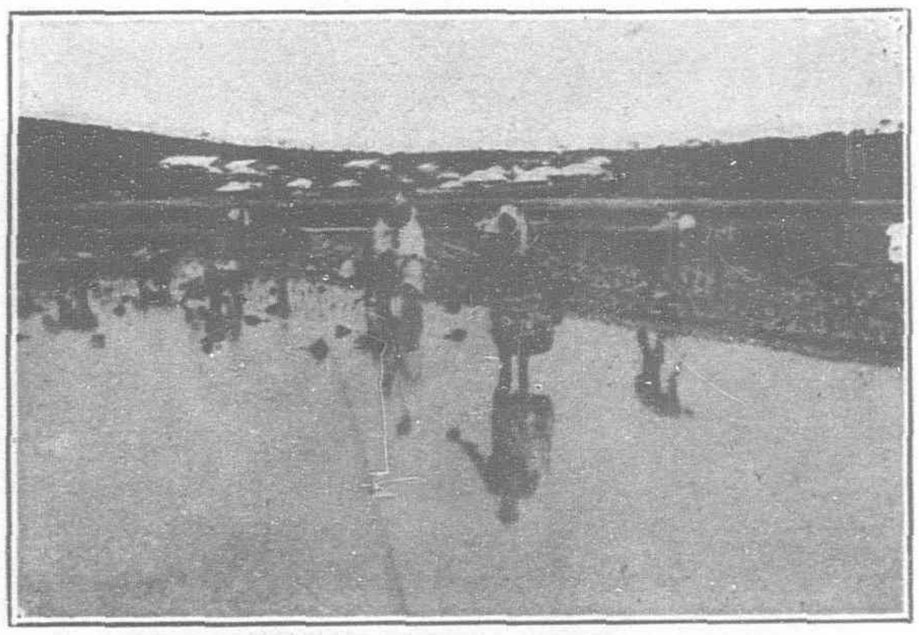
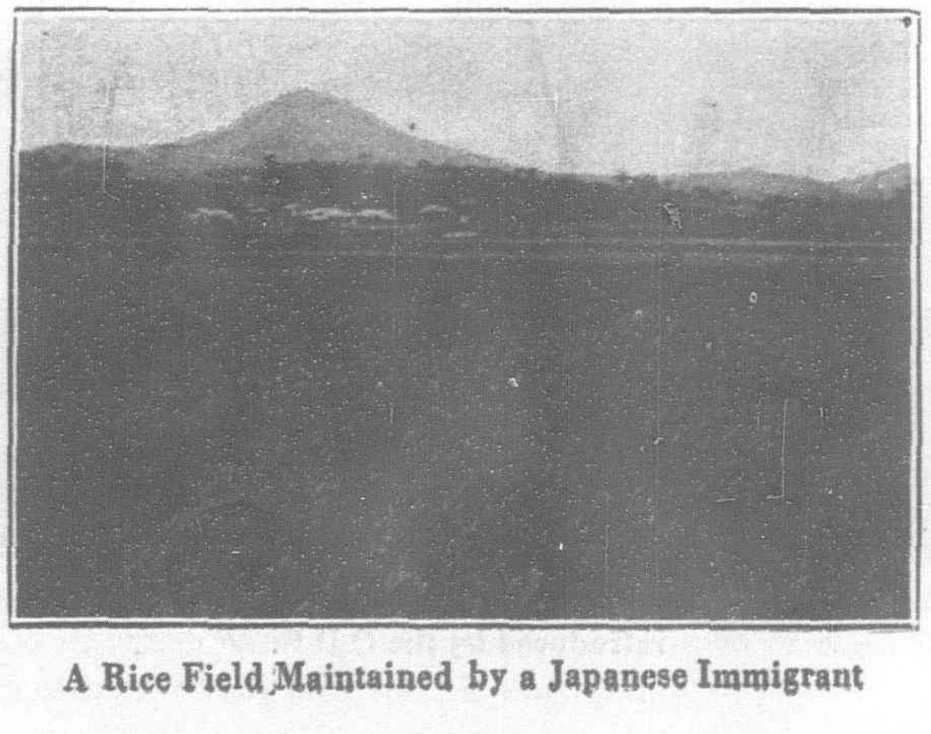
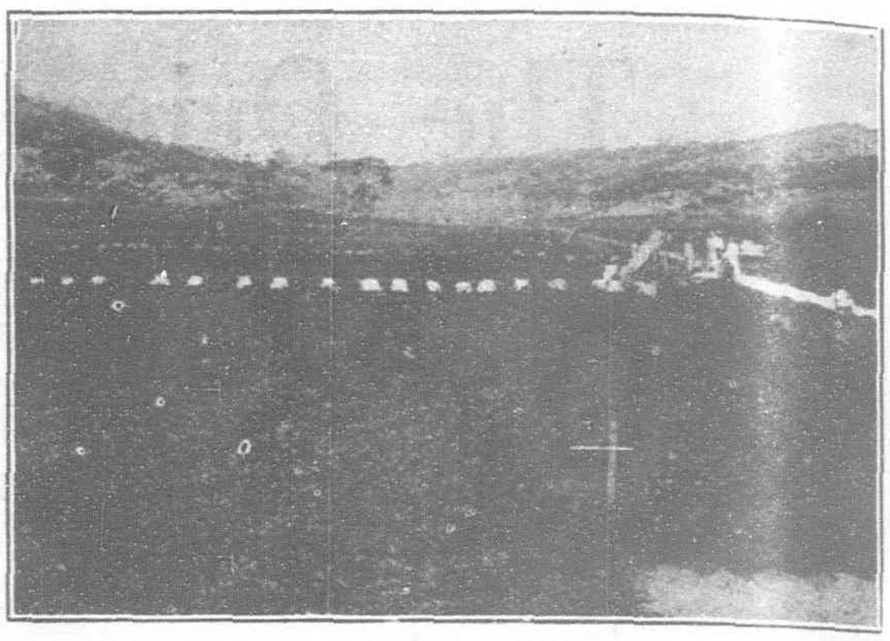


Japanese Immigrants Planting Rice

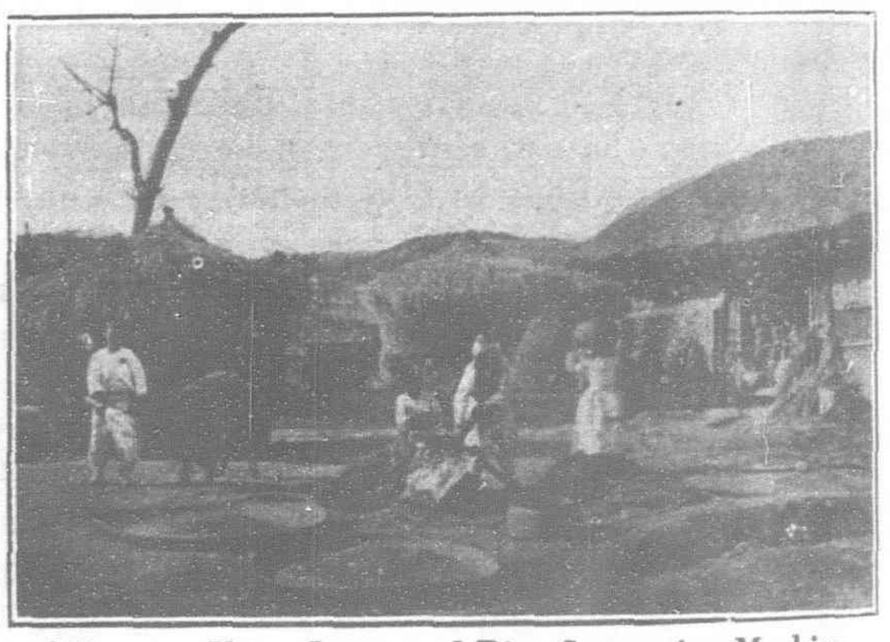


A Rice Field Maintained by a Japanese Immigrant

By 1919 the operations had so far changed their character that of Y.70,257,000 advanced only Y.32,595,500 were lent in Korea, where the average loan had declined to Y.4,700, against Y.37,200 for the Mukden branch, 15,500 for Dalny, 54,500 for Kharbin and 52,600 for Tsingtao. Nine loans attributed to the Tokyo head office give an average of Y.336,800 per loan. Agricultural development still claimed the largest proportion of the 1919 loans, though mining and industries begin to bulk more largely, and transport and communications account for a rapidly expanding sum. It may be presumed that the substantial amount of Y.19,806,200, described as for "streets laying," relates to roads, otherwise it would appear that an organization designed for rural development was paying too much attention to urban facilities. In any case it is evident that the company originally intended to fulfil the duty of assisting production in Korea has increasingly becomeaninstrument for developments in Manchuria, Mongolia and China, which since Europe went to war have had to depend more and more on Japanese capital and enterprise for their advancement.



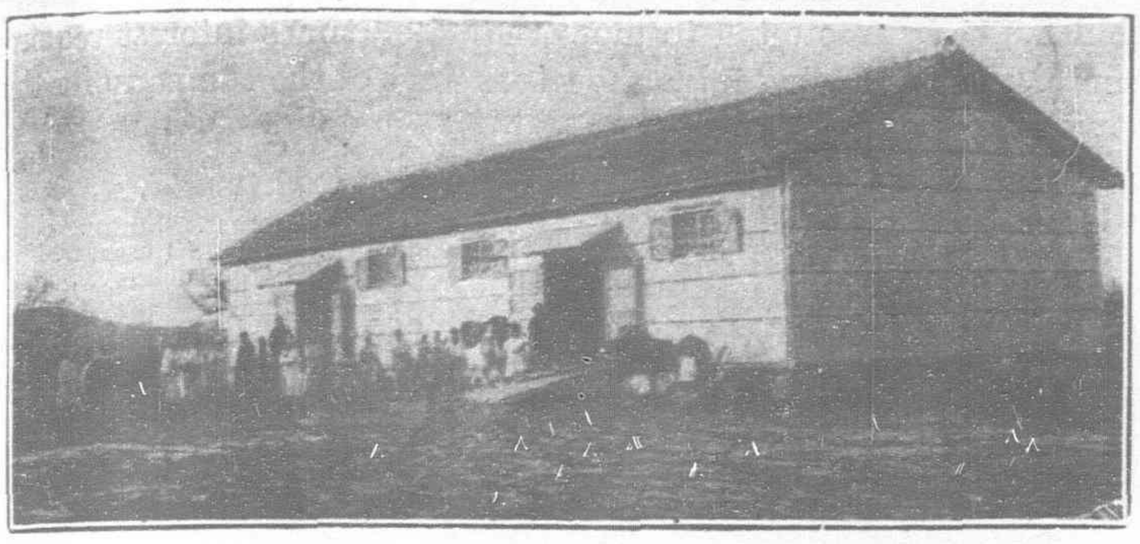
Seedling Station of the O.D.C. at Tokuson, Korea



Koreans Using Improved Rice Separating Machine Furnished by the O.D.C.

The extent of lands now in possession of the company which is regarded as constituting its most important asset is 252,273 acres and upwards. It consists of paddy fields, upland farms, forests, residential and lands unclassified. The actual value of all these lands is not less than Y.100,000,000. The company has also acquired lands and buildings to a considerable extent in China. To give the principal instances, it purchased lands and buildings worth Y.1,700,000 in Tsingtao which had been in the possession of Germans under the control of the Chinese government. With these new acquirements the company started an

industrial concern. In Tientsin it purchased similar real estate to the value of Y.700,000 and upwards and opened a sister company therewith. In the same place, the company also purchased other lands and buildings amounting to Y.800,000, approximately.



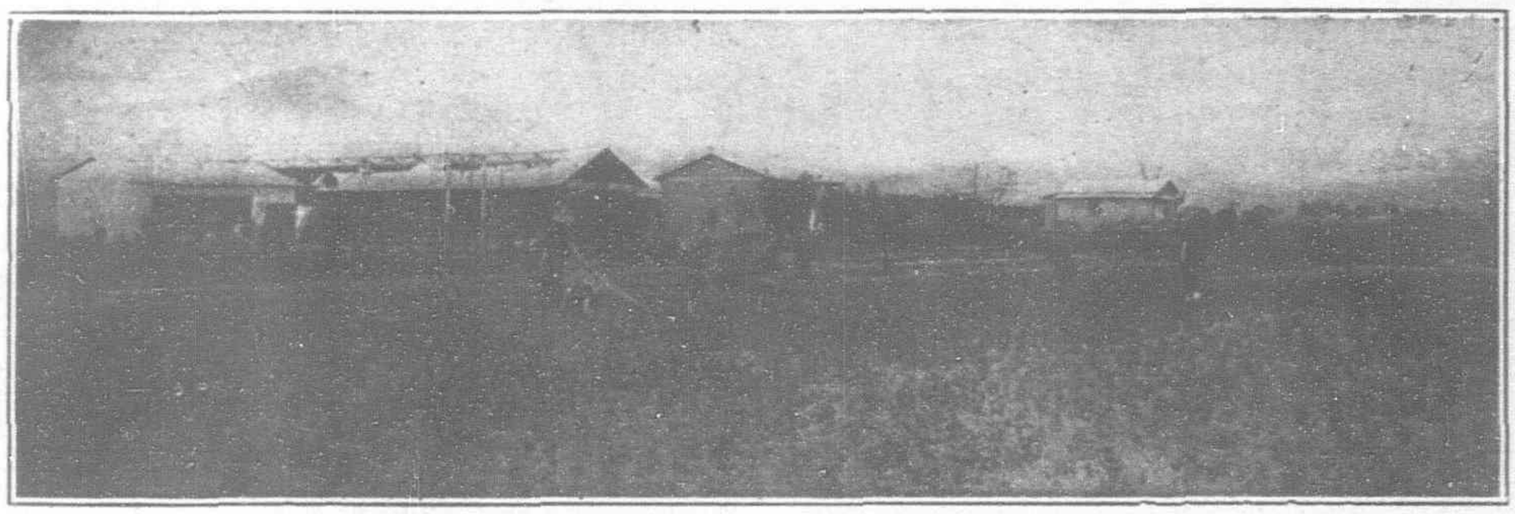
Keisan Grain Warehouse of the O.D.C. near Taiko

Under its agreement with the Japanese government the company undertakes the following :—

First, supply funds for development ; second, develop agricultural and water power resources and acquire, manage and dispose of lands ; third, recruit and dispose of settlers necessary for development ; fourth, construct, purchase, sell, lease and rent buildings necessary for settlers ; fifth, furnish settlers and farmers with the necessities of development and dispose of articles produced by them ; sixth, manage and take charge of lands in trust ; seventh, receive fixed deposits, and carry on other enterprises.

In general the Oriental Development Company is engaged in the work of banking, fostering the growth of agriculture and industry and giving facilities to settlers.

With the annexation of Korea as an integral part of the Japanese empire, the program of the company naturally underwent some changes. In one of its principal aims, that of inviting Japanese farmers to the peninsula, the company was not very successful. Now that every Korean is a Japanese subject, there is little use in introducing Japanese, save that their presence among the Korean farmers might lead to improvement in their condition by the example set them of better farming. The result of this particular venture is seen in the following table :—



Farm Operated by O.D.C. Tenants

Year	Applicants Accepted	Number of Successful Settlers	Lands Appropriated	Funds Advanced
	Families	Families	Families	Members	Acres	Yen
1910 ..	1,253	160	118	531	532	13,034
1911 ..	1,714	720	337	1,516	1,448	33,410
1912 ..	2,086	1,167	640	2,880	2,914	60,963
1913 ..	3,465	1,316	568	2,556	2,563	40,874
1914 ..	1,964	1,108	432	1,944	1,946	20,899
1915 ..	1,284	774	293	1,318	1,434	13,520
1916 ..	1,101	542	250	1,125	1,103	14,030
1917 ..	1,552	650	340	1,530	1,875	13,830
1918 ..	1,528	598	479	2,155	3,926	—
Total ..	15,929	7,035	3,457	15,555	17,741	20,360

The great difference between the number of applicants and that of those accepted shows the care exercised by the company in the selection of immigrants in order to secure the best.

In other respects, the company has generally done very well. Especially successful has it been in the work of irrigation and reclamation. Many a stretch of waste land hitherto lying idle on account of lack of irrigation has been converted into the best of farm land, and rented to Korean farmers or Japanese settlers. Its horticultural farm in Tuksum is perhaps only next to the government horticultural garden in the same place in size as well as in perfection of equipment. In afforestation the company has obtained a lease from the Government of an area of no less than 75,187 acres, part of which has already been afforested and part is under way. As the supplier of agricultural funds it has also achieved signal success and rendered valuable service to agricultural development in general. Since its head office was removed from Seoul to Tokyo, and the scope both of the nature of its undertakings and its fields of activity greatly widened, it has come to partake of the nature of an underwriting company, and has already an active interest in quite a number of industrial companies in Chosen, Manchuria, and Japan. As in the case of the Bank of Chosen, Manchuria was for a time its principal field of investment.

Advances

Forms of advances and their term made by the company are as follows :

(1) Advancing loans to immigrants on the terms of annual redemption within a period not exceeding 25 years or redemption at a fixed date within a period not exceeding five years.

(2) Advancing loans (by means of discounting bills) to producers on security of their products on the terms of redemption within a year.

(3) Advancing loans on security of real estate, railways, mining rights and rights established on real estate on the terms of annual redemption within a period not exceeding 30 years or redemption at a fixed date within a period not exceeding five years.

(4) Advancing loans to industrial associations founded in accordance with special law without security on the terms of annual redemption within a period not exceeding 30 years or redemption at a fixed date within a period not exceeding five years.

(5) Advancing loans without security to a party of argiculturalists not less than 20 in number taking upon themselves joint responsibility for their obligations on the terms of redemption at a fixed date within a period not exceeding five years.

(6) Taking up shares or debentures of companies having for their object the immigration or colonization business.

(7) Advancing loans on deposit of shares or debentures issued by companies engaged in immigration or colonization on the terms of redemption at a fixed date within a period not exceeding five years.

(8) Advancing loans on security of financial associations founded in accordance with law or of other trustworthy things on the terms of annual redemption within a period not exceeding 30 years or redemption at a fixed date within a period not exceeding five years.

Purpose of Present Loan

The proceeds of the present issue will be used to redeem Y.15,000,000 ($7,500,000) of debentures of the company now outstanding, to retire Y.10,000,000 ($5,000,000) of bank loans, and the balance to aid in the development of the company's business in Japan and its colonies, principally Korea, for economically productive purposes.

Assets

Among the assests, the land owned by the company, amounting to 253,272 acres, together with improvements, excluding buildings, represented an investment March 31, 1922, of $9,996,363, and a present estimated value of approximately $50,000,000. This with improvements, including buildings, is carried in the balance sheet, as of February 22, 1923, at only $15,814,694.

Capitalization

The capital stock and funded debt of the company outstanding February 22, 1923, adjusted to include the present financing, was as follows :

Capital stock, fully paid	$10,000,000	
Capital stock, 50% paid	7,500,000	
Total paid up capital		$17,500,000
6% debenture loan of 1923 (this issue)		19,900,000
5% debenture loan of 1913 (French issue Fcs. 33,026,000)		6,375,675
Internal debenture loans		57,087,800
Total capitalization		$100,863,475

The only loan of the company to be presently outstanding, which will bear the guarantee of the imperial Japanese government, other than this 6 per cent issue of 1923—purchased by you, is a French 5 per cent. loan originally issued for Fcs. 50,000,000 ($9,625,-500) and outstanding February 22, 1923 to the amount of Fcs. 33,026,000 ($6,375,675). The internal debenture loans are not guaranteed. The French loan was issued in Paris in 1913 on a 5.22 per cent. basis and has sold at average prices to December 31, 1922 to show an average annual yield of 5.85 per cent. The bonds were quoted in Paris February 22, 1923 to yield 5.21 per cent.

Balance Sheet

The condensed balance sheet of the company as of February 22, 1923 was :

Assets—

Land owned, with improvements, including buildings	$15,814,694
Loans due from municipalities, corporations, farmers and others, payable at fixed dates or in installments	60,400,148
Shares and debentures owned	11,712,567
Cash on hand and in bank	15,504,332
Other miscellaneous assets	3,254,445
Total assets	$106,686,186

Liabilities—

Capital stock authorized and subscribed, par value Y.50 ($25)	$25,000,000	
Capital stock subject to call	7,500,000	
Capital stock paid in		$17,500,000
Bonds outstanding		70,978,331
Bank loans, deposits and other current liabilities		12,338,049
Miscellaneous liabilities		1,374,570
Surplus and reserves		4,495,236
Total liabilities		$106,686,186

The above balance sheet does not include the $19,000,000 6 per cent. bonds of the present issue.

Earnings

Net earnings of the company during the ten years ending March 31, 1922 have amounted to more than 1.93 times interest requirements. The following table shows earnings of the company for this ten-year period :—

Year Ending March 31	Gross Earnings	Operating Expenses	Net Earnings	Interest Payments	Available for Sinking Fund. Reserves, Dividends & Surplus
1913 ..	$1,032,265	$511,341	$520,923	$234,590	$286,333
1914 ..	1,519,635	596,700	922,936	488,759	434,177
1915 ..	1,431,119	522,366	908,752	495,255	413,498
1916 ..	1,390,318	451,953	938,366	436,568	401,798
1917 ..	1,465,403	518,038	947,365	422,014	525,450
1918 ..	2,223,716	1,045,261	1,178,455	553,621	624,834
1919 ..	4,113,500	1,278,508	2,834,992	1,261,091	1,573,901
1920 ..	5,921,592	2,539,008	3,382,584	1,917,274	1,465,310
1921 ..	6,679,865	2,323,318	4,356,547	2,127,961	2,228,586
1922 ..	8,916,949	2,288,244	6,628,705	3,778,706	2,849,999
Total ..	34,694,362	12,074,737	22,619,625	11,715,839	10,903,786
1923 (estimated) .	9,549,778	2,191,359	7,358,419	4,469,631	2,888,788

The capital stock of the company outstanding in the hands of the public has received dividends regularly since the organization of the company in 1908 at rates ranging from 6 per cent. to the present rate of 10 per cent. per annum. The stock sold on the Tokyo Stock Exchange on March 19, 1923 at 112 per cent., which indicates a stock equity of $19,600,000 junior to the total funded debt of the company.

The American loan to the Oriental Development Company will come as much needed assistance for the development of many legitimate enterprises in Korea where, to date, the Japanese have provided 85 per cent. of the capital for the 1,500 factories already established there. Many private and industrial railways and other enterprises have been held up these past two years for the lack of capital and it goes without saying that if foreign capital participates in this development, a market will be opened in Korea for manufactured articles that will expand rapidly under Japanese management.

Hammering the Loan

It was to be expected that the anti-Japanese clique in China would initiate some move to discredit the Oriental Development loan.

This element has again seen fit to question the wisdom of Washington and Wall Street and through *The Weekly Review* we learn that "*it has produced condemnatory resolutions on the part of both Chinese and foreign chamners of commerce. The apprehension is due to the fear in China that this loan is the beginning of a financial policy on the part of certain American banking group to lend money to Japan for the purpose of furthering Japanese imperialistic projects on the continent of Asia. Considerable apprehension has also been aroused in American commercial circles for fear that this policy might be detrimental to American commercial interests in China.*"

We are informed that the American chamber of commerce of China at Shanghai has passed no such condemnatory resolutions.

(Continued on Page 320)

Hanyang Iron and Steel Works at Hanyang: General View of Steel Works Department from Tortoise Hill

Blast Furnaces and Steel Mills in China

A Comprehensive Survey of China's Steel Industry

By Lansing W. Hoyt

IT is not the purpose of this article to enter into an academic discussion of China's iron resources. A great deal has been written by geologists on this subject, and it would be a waste of time to recapitulate. This is an attempt, however, to place before Americans interested, certain phases of the iron and steel situation now prevailing in China from an operation standpoint. In doing this, of course, the iron ore and coal properties furnishing raw materials to the iron and steel companies will be described.

There is not a great deal of information available in America covering blast furnace and mill practice in China and Manchuria. That available is to a large extent too partial to China. Considerable publicity has been wrongly given the wonderful resources supposed to be at the disposal of Japan in Manchuria and other parts of China through the enterprise of her iron and steel engineers.

From a blast furnace operation standpoint Manchurian ore acts very unsatisfactorily. It is too low in iron content (30 per cent.) and will have to be concentrated before successful furnace practice is possible. This concentration is practicable, but the additional cost may prove too excessive. Manchurian coke is high in ash (16 per cent.) and moisture (10 per cent.) and none too good for the work in hand. It will be many years before blast furnace practice in China and Manchuria even approaches the efficiency so common and necessary in the United States.

For purposes of discussion, it is convenient to separate China's iron plants into three distinct groups, namely: the Hankow district, the Peking (Chihli) district, and the Mukden, or Manchuria, district. These three groups embrace every blast furnace and mill thus far erected in China. At present there are twelve completed blast furnaces, varying in age from one year to thirty years. By this is meant the period which has elapsed since they were "blown in" for the first time. Their rated individual daily output ranges from 100 tons to 450 tons of pig.

The author of these reports is the American trade commissioner at Shanghai, who, before entering the government service, was for many years connected with the United States Steel Corporation and the Tata Iron & Steel Company, Ltd., of India. Mr. Hoyt is, therefore, an authority on his subject, and was instructed by the department of commerce last year to draw up the report on China's steel industry. These reports, since released by the bureau of foreign and domestic commerce, are undoubtedly the most careful and reliable ever presented to the technical press. The reports emphasize the slow progress of steel manufacture in China due to many natural and economic causes which together make it possible for foreign material to be delivered in China and undersell the home product.

General View of Blast Furnace Department from Tortoise Hill

Rated Daily Output of Chinese Furnaces

3	Furnaces	at	100	tons.
2	,,	,,	130	,,
2	,,	,,	200	,,
3	,,	,,	350	,,
2	,,	,,	450	,,
Total 12	,,		2,610	,, Total Rated Output.

If Chinese blast furnaces and Japanese blast furnaces in China lived up to their rated capacity, the respectable total of about 900,000 tons of pig iron would be produced yearly.

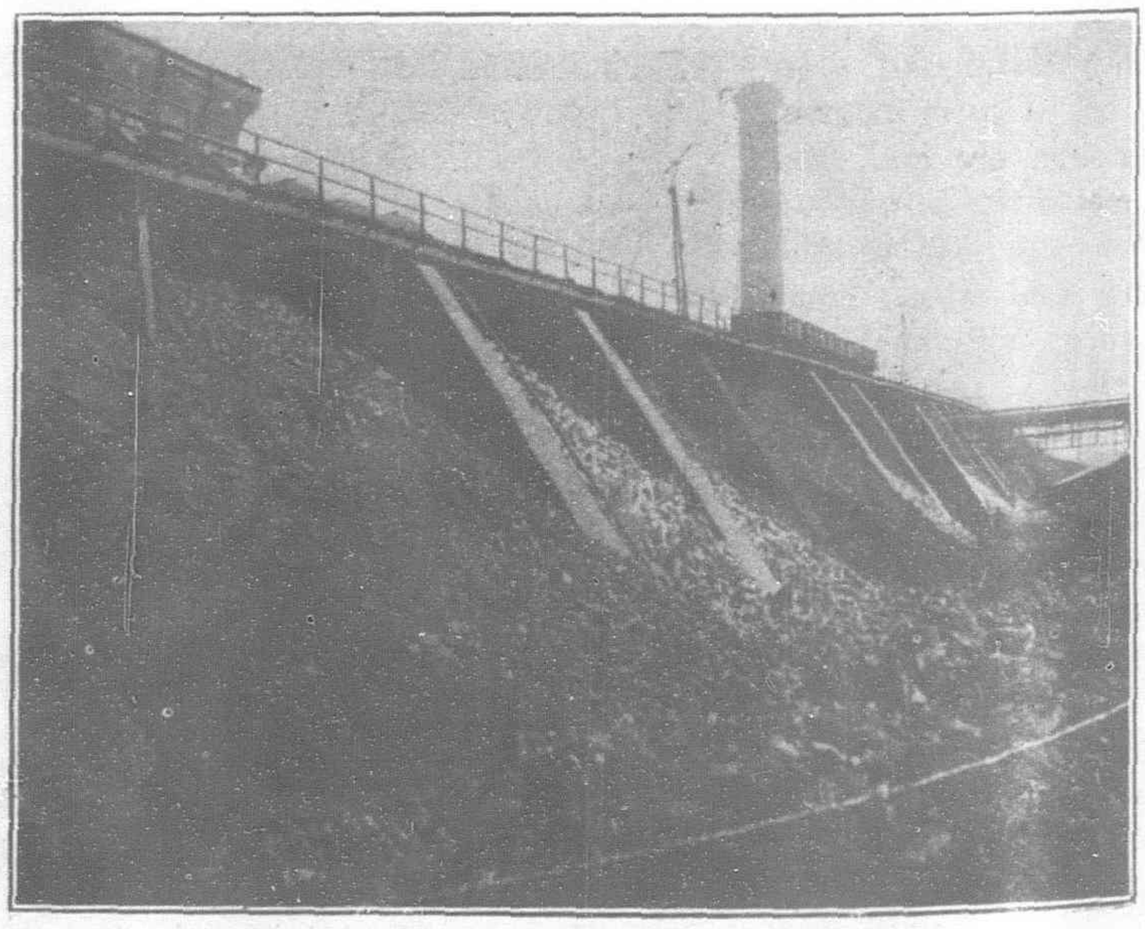
In August, 1922, however, but 500 tons of pig was being cast daily which gives a yearly rate of only 180,000 tons. This rate will not be exceeded, at least until 1924. This shrinkage in production is not due entirely to the present depression in business. Only four blast furnaces are out of blast owing to the 1921 drop in price of pig. These four furnaces, idle through lack of funds, have a total rated capacity of 220,000 tons per year.

Two other furnaces, with a capacity of 73,000 tons yearly, are enjoying a forced retirement owing to their obsolete design.

Adding these tonnages together, it is evident that about 300,000 tons (293,000 exact) of pig making capacity is out of business due to causes beyond the control of the management or the present economic depression.

Deducting this total from the 900,000 tons of rated capacity for the whole of China and Manchuria, we find that 600,000 tons of iron should now be the annual output of the entire country. But on August 15, 1922, the yearly rate was roughly only 200,000 tons (180,000 tons exact), leaving a 400,000 tons deficit which must be chargeable to poor design, faulty construction and inefficient blast

Front of Casting Halls of Furnaces 3 and 4. Blast Furnace Department



New Elevated Track, Showing Ore and Limestone Bins

furnace practice and management. These figures are a sad commentary on the ability of interests in China to produce iron in an efficient manner.

The Hankow District

There are two companies owning blast furnaces in this district. The leading interest is the Han-Yeh-Ping Iron and Coal Co., Ltd. This is by far the largest plant in China. This company owns six blast furnaces, a rail mill, plate mill and bar mills. The other company, the Yangtsze Engineering Co., owns but one 100-ton blast furnace, besides its engineering works, or bridge shop. The furnace is now out of blast. It shut down about January, 1922.

The Han-Yeh-Ping Co. is likewise the only company in China which has ever manufactured rolled steel products. This company derives its name from a combination of certain syllables in the names of its subsidiary organizations. These subsidiaries are: Hanyang Iron and Steel Works; Tayeh Iron Mines, Pingsiang Colliery, and the Yanghsing, Changlai and Changnien Manganese Ore Mines. The Hanyang Iron and Steel Works, founded in 1890 by a viceroy of Hupeh province, gets its iron ore from a place called Tayeh, 80 miles downstream from Hankow. In 1907 the Hanyang Works and the Tayeh Mines were amalgamated with the Pinghsiang Colliery into the present parent company.

Hanyang Iron and Steel Works

These works are located at the confluence of the Han and Yangtze Rivers and are within a mile of Hankow proper. Hankow is the largest city in central China, having a population of 1,300,000. It is a terminus of the Peking-Hankow Railway and when the other railways are completed will be the terminal for both the Canton-Hankow Railway and the Hankow-Chungking line. Hankow is about 700 miles from the sea.

The site of the plant appears to be ideal when first seen, but even a cursory inspection soon develops the fact that the area is too cramped (110 acres) for efficient operation. The only advantage the location possesses is good water transportation, but this advantage also obtains in other areas near Hankow which would have been much more suitable to present-day furnace and mill practice. It is said that only Viceroy Chang, the founder, insisted on the plant being near enough to his palace so that he could see the furnace gases by day and the cast house flare by night. The fact that the site chosen was very low and almost marshy caused considerable trouble later on when additional plant necessitated heavier foundations. Also the ground water always present has been a constant annoyance at the open-hearth where frequently trouble is caused by damp checker chambers. On the Yangtze River front, a very modern ore bridge with two grabs of English design (Frazar and Chalmers Engineering Works) handles the Tayeh ore and limestone which is delivered close to the wharf during the high water season, but which must be unloaded from a point 130 feet further out during low water. This fall in water level necessitated the building of cantilevers capable of sustaining large grabs working at times almost 150 feet from the face of the wall. When the grabs are working on the extreme end there is an upward pull of 120 tons on the four rear columns. The overturning movement is counteracted by a 500-ton block of concrete. The unloader consists of two transporters, 50 feet between centres. Each transporter is fitted with a traveling carriage from which is suspended a crane capable of revolving 360°, while operating a grab weighing 7 tons empty and 11 tons full. The total weight of each grab and its transport is 43 tons. Owing to the high lift (75-ft. at times) and to the 650 feet carry to the bunkers and back, the rate of urloading is curtailed somewhat. While the bridge is rated at 100 tons an hour per grab, Chinese operators generally unload at the rate of about 70 tons for each grab. Even this rate works out much cheaper than coolie labor and ensures a steady handling of material under conditions of weather.

No arrangements, other than coolie labor, have been made to handle the coke which arrives from Wuchang in lighters on the Han River side. When operating to capacity, the Hanyang plant handles at its two wharfs about 3,000 tons of raw materials daily. All these raw materials come from the other side of the river. The ore and stone comes from Tayeh, 80 miles down stream, and the coke from Pinghsiang, 310 miles south by rail from Wuchang, the city opposite Hankow on the Yangtze. This means that all the coke must be rehandled at the river, a rather expensive proposition even with cheap labor. The ore and stone being transported by water direct from the loading wharf on the Yangtze (which point is only 15 miles from the Tayeh Mines) comes to the plant under comparatively low freight and labor charges. The ore docks at the Hanyang Works are operated under the shipping department which also controls the movements of the Company's 200 lighters and 21 tugs. The handling of the raw materials as far as the blast furnace stock house is done as well as could be expected. The coolies employed on coke handling are the only source of annoyance to an American eye from a raw material standpoint.

Cost of Raw Material at Hanyang Works

(Costs have appreciated greatly during the last six months. Figures during Second Quarter 1922 given).

Pinghsiang coke at stock house	...	...	...	G.	$18.00	per	ton.		
Tayeh iron ore	,,	,,	,,	...	...	...	,,	2.80	,,	,,
Tayeh limestone	,,	,,	,,	...	...	...	,,	2.30	,,	,,
Native iron scrap at stock house (limited)					...	...	,,	2.00	,,	,,

From the above it is readily seen that cheap pig iron is out of the question at Hanyang even if furnace operation itself were perfect. Burden sheets of Hanyang blast furnaces show that it requires on an average:

3,000-lbs. coke to make one ton of pig iron.
900 ,, limestone to make one ton of pig iron.
3,500 ,, iron ore ,, ,, ,, ,, ,, ,, ,,

Taking 100 per cent. as the cost of one ton of pig, the cost sheets show that the raw materials enter into this cost in the following proportion:—

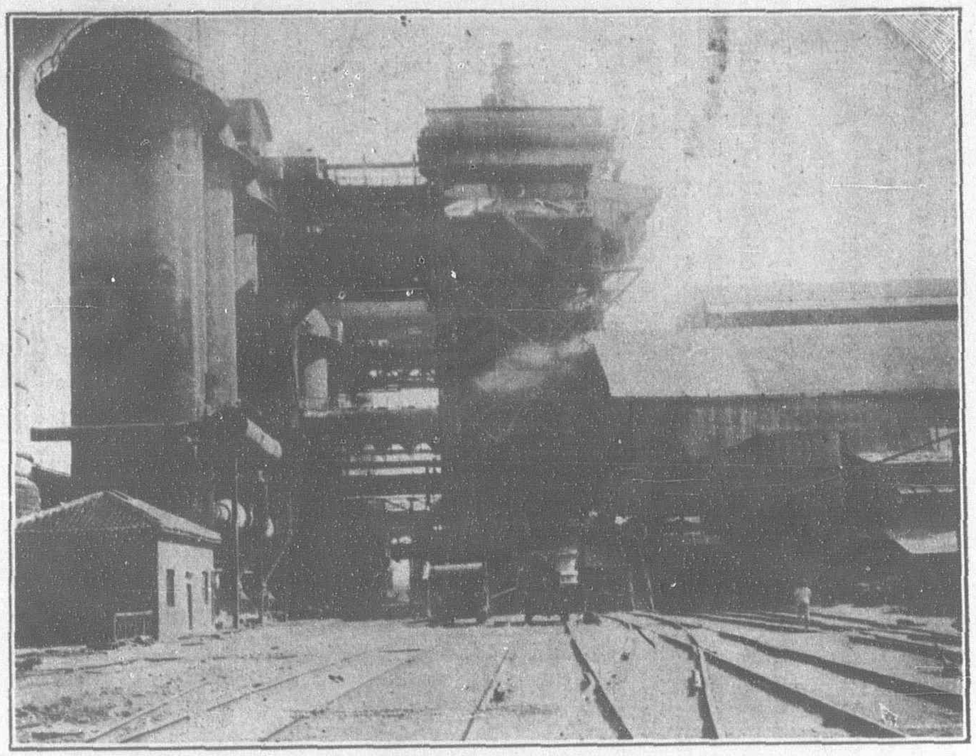
Coke	Iron Ore	Limestone and Manganese Ore	Total	Power, Interest, Labor, Overhead, etc.
55%	13½%	4½%	73%	27%

With coke at G.$14.00 per ton and a consumption of 1⅓ tons per ton of pig made, we get a coke cost in gold dollars of 18.60. If the coke cost is 55 per cent. of the total cost of a ton of iron at the cast house, the cost of pig is therefore G.$33.90. Labor costs entering into this figure do not exceed 2 per cent. or about 67 cents gold per ton. The balance of 25 per cent. takes care of power, depreciation, interest charges and all overhead. Interest charges add $4.00 gold to the cost of pig at Hanyang.

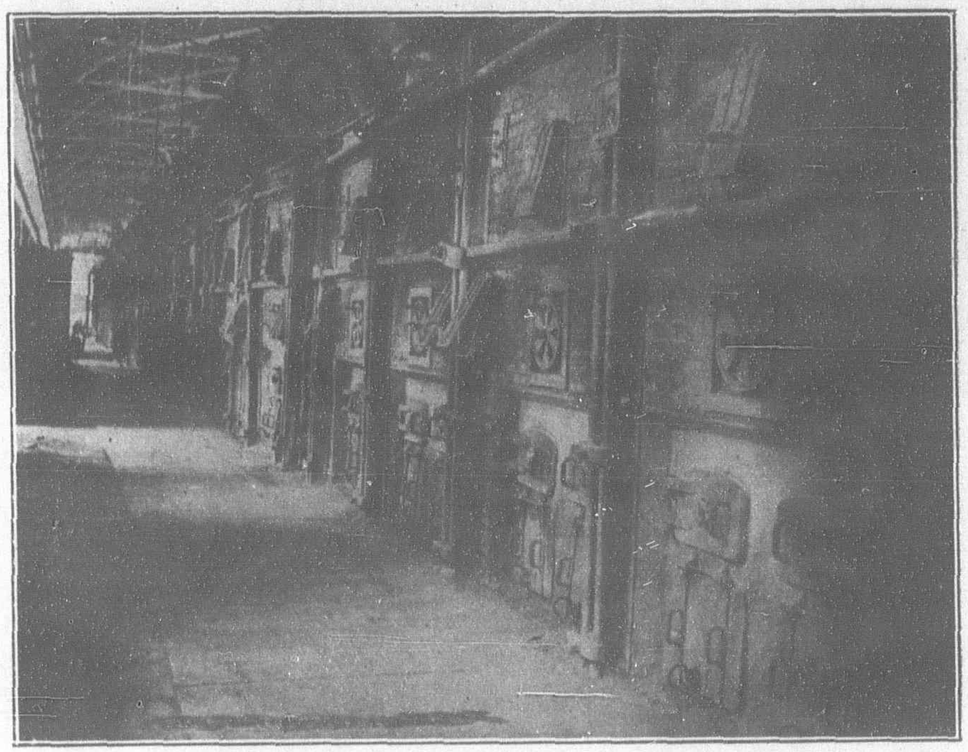
Furnaces No. 1 and No. 2 (British) were erected about 30 years ago and were each producing 100 tons a day, but they were blown out 1920. They are nearly obsolete now and it is almost certain that they will never make pig iron again. They are brick "stacks" with steel band re-inforcing around the bosh, having no metal shell. Four Cowper stoves and one gas cleaner served each furnace. The blast is supplied by one horizontal compound Cockerill blower and three vertical two cylinder Teeside blowers. Excess furnace gases fire eleven Lancashire and three B. & W. boilers.

Furnaces No. 3 blown in during 1910 and No. 4 in 1913 were built by Germans. They are of 250-ton daily capacity and from an operating standpoint work fairly well. These furnaces are hand filled, the buggies containing raw materials being loaded below and hoisted by elevators to the charging floor. Blast pressure is about 6-lbs. per square inch and is supplied by three turbo blowers, one of which is used as a spare. Two of these blowers are Parsons and the other was built by Richardson, Westgarth & Co. of England. They are capable of delivering 30,000 cu. ft. of air per minute at a pressure of 9-lbs., but under local conditions 6-lbs. is sufficient. Lancashire and B. & W. boilers, fired by excess furnace gas, furnish the steam.

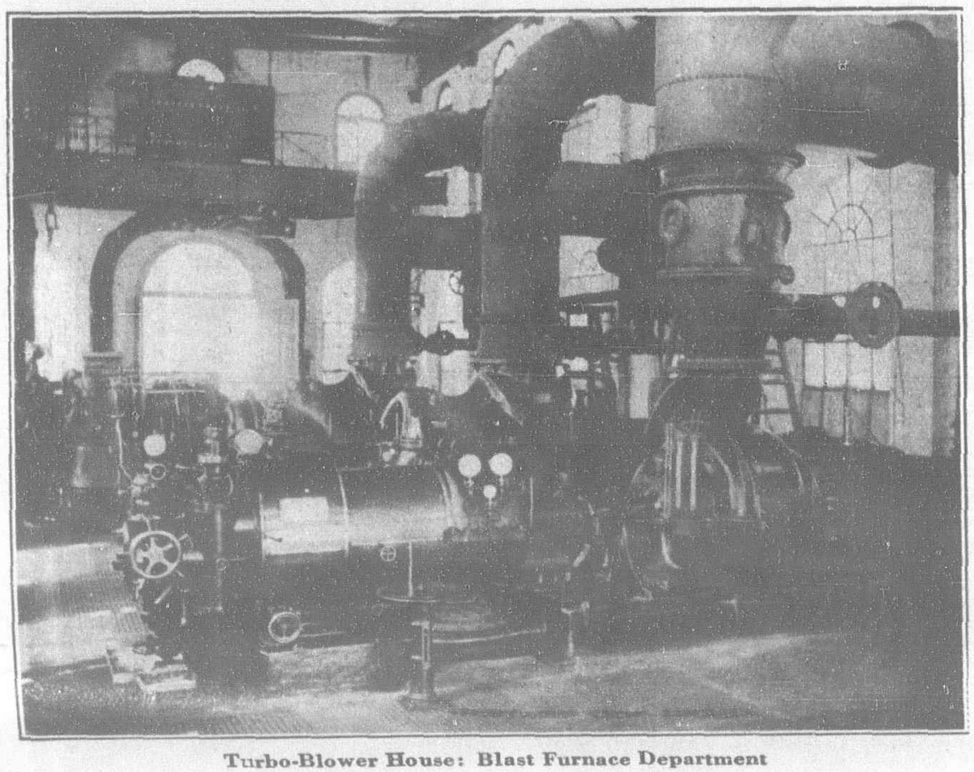
These furnaces are the only ones in blast in the entire Hankow district, but even they are being operated at a loss, all costs considered.



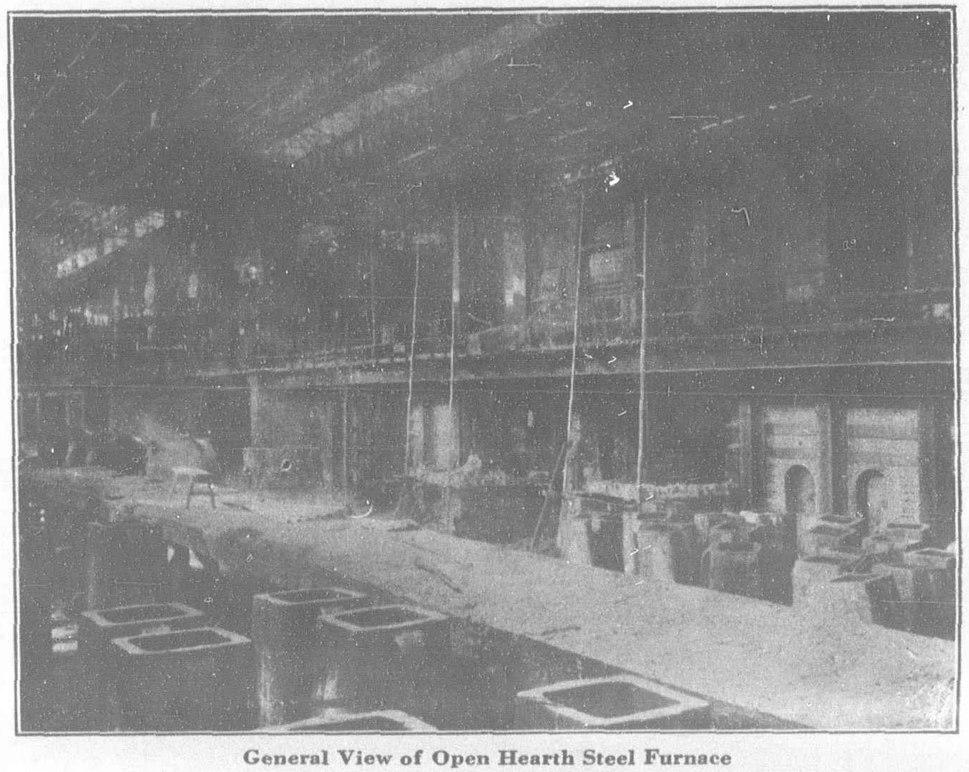
Blast Furnace No. 3



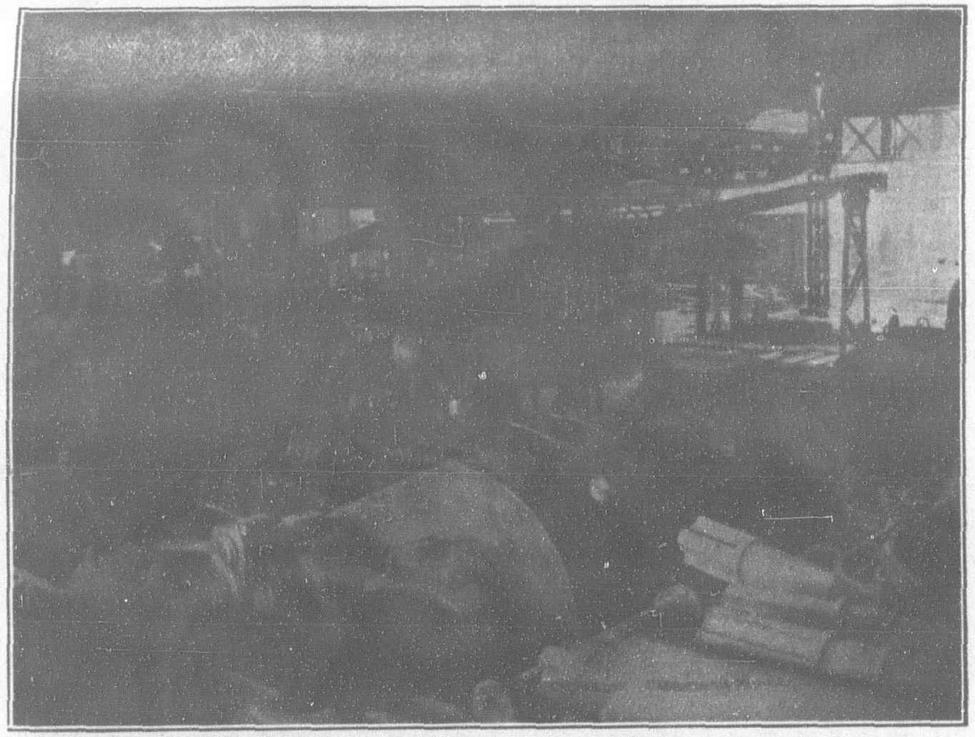
Gas Fired Boiler Battery; Blast Furnace Department



Turbo-Blower House: Blast Furnace Department

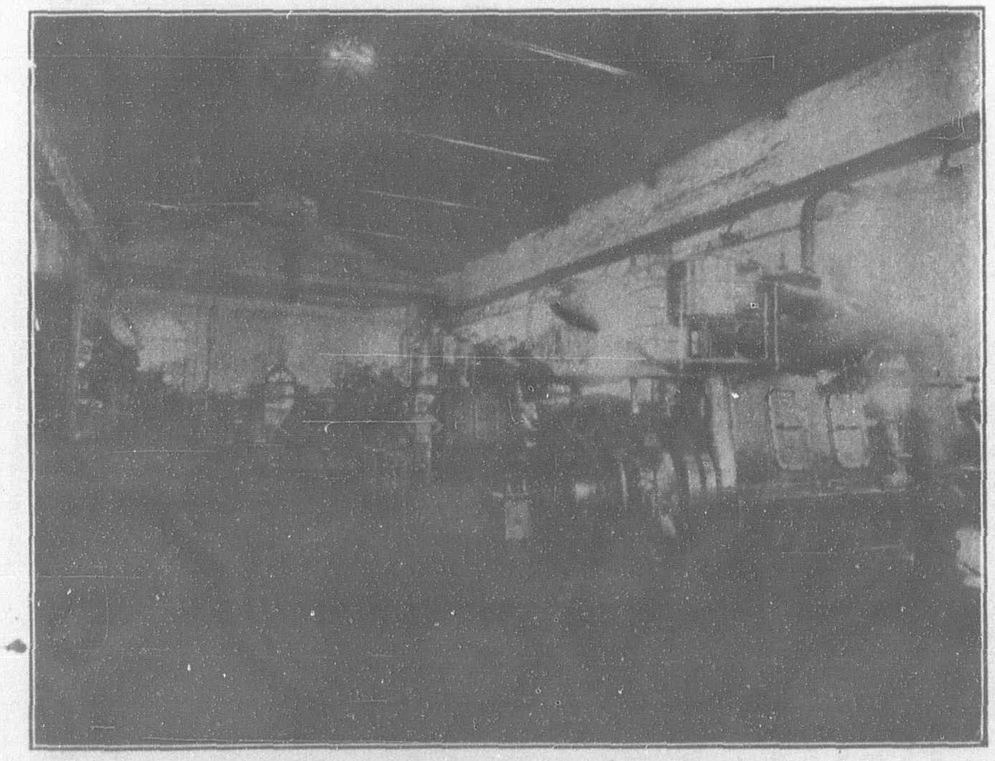


General View of Open Hearth Steel Furnace

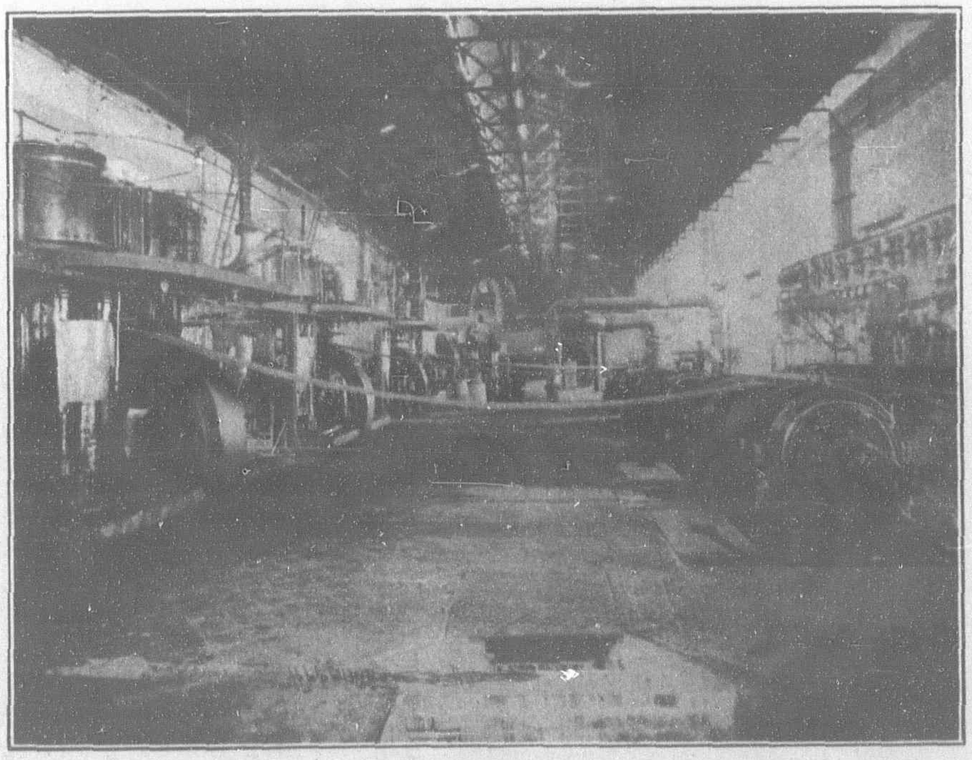


Cogging Mill and Plate Mill Engines, 8,500 H.P. each: Steel Works Department

Hydraulic Station, Showing Hydraulic and Boiler Feed Pumps: Steel Works Department



Power Station No. 1 : Mechanical Department



Power Station No. 2 : Mechanical Department

Unless assistance of some sort is arranged, it is difficult to understand how operation can be continued by the present management. The Tayeh mines are well situated and the ore contains about 60 per cent. iron. With 40,000,000 tons in sight, these mines alone are very good security. The ore is the best in China and is the equal of most ores in America.

Analysis of Ore and Coal from which Coke is Made.

Ore:			Coking Coal:		
Fe	59.45	per cent.	Fixed carbon	54.118	per cent.
Mn	63	,, ,,	Gaseous matter	23.490	,, ,,
S	.119		Combined water	1.392	,, ,,
P	.109	,, ,,	Ash	21.000	,, ,,
Al O	1.05	,, ,,			
Cu	.292	,, ,,			
Si O	9.16	,, ,,			

Looking at the coal analysis, it is evident that the coke will contain considerable ash. This is the case, the average ash content being about 18 per cent. The moisture in the coke is also very high, being about 10 per cent. or even more.

With coke containing 10 per cent. moisture and 18 per cent. ash, it is readily seen why, despite a good ore, it takes 3,000-lbs. of coke to make a ton of pig. An additional drawback to efficient blast furnace practice at Hankow is the moisture in the air. Hankow is one of the wettest spots in the Far East from a humidity standpoint. This is especially so during the summer months. This highly saturated air eats up considerable coke, although no exact figures are available as to how much coke thus goes for naught.

The pig iron made at the Hanyang Works is a good product. No. 1 foundry iron has the following analysis :—

Si	*Mn*	*P*	*S*
2.75	0.50	0.150	0.03

Basic pig used at the open hearth furnaces runs about :—

Si	*Mn*	*P*	*S*
1.00	1.25	0.150	0.03

Slag from the furnaces is used for fill, but a brick making plant consumes a fair amount. Bricks made at Hanyang are sold locally for building purposes. The pump-house supplying cooling water to the bosh plates, tuyers coolers and cast house contains five Hess motor-driven turbine pumps and one steam pump driven by a Bellis and Morcum engine. This is an ample supply because under normal operation three pumps only are required.

At the present time all the foundries iron produced is cast in sand pig beds in the cast house adjoining the furnaces but basic in iron moulds. Eight casts are made per day from each furnace. The pig is hand broken by coolies and carried out of the cast house when cool to cars which transport it to the loading wharf. When the open hearth steel furnaces were operating some of the molten pig is cast into hot metal ladles, which in turn were emptied into the 150-ton mixer at the open hearth.

Pig Iron Production at Hanyang (Furnaces Nos. 3 and 4).

1915...	136,531 tons.
1916...	149,929 ,,
1917...	149,664 ,,
1918...	139,152 ,,
1919...	166,096 ,,
1920...	126,305 ,,
1921...	126,496 ,,

The above figures show that while Nos. 3 and 4 furnaces are rated at 250 tons, actual production was only about 200 tons. Time out for re-lining and "banking" reduced production. Due to good ore, fair coke, and lack of innovations in construction, these furnaces from a metallurgical standpoint operate better than most Chinese furnaces.

Open Hearth Steel Works at Hanyang

The steel-making plant at Hanyang (this is the only one in China) consists of seven 30-ton basic open hearth furnaces and one 150-ton mixer. There is nothing unusual about the furnace layout. These furnaces were built about 15 years ago to furnish steel ingots for the blooming mill installed at the same time. They would be considered too small for efficient operation in America, but there are numerous furnaces similar to those in operation in England and Europe. The checker chambers and air and gas flues are too far underground, moisture being prevalent on this account. The slag chambers are not large enough to efficiently protect the checker-brick from slag deposits. The furnaces proper are not long enough to allow of complete combustion before the gases reach the outgoing ports. This causes the ports to wear back much quicker than would otherwise be the case, and the gas flow is more difficult to direct due to this erosion. After the furnaces have been operated awhile the gases too readily attack the roof with a consequent shortage of life for the furnace. A run of 200 heats on a roof is considered excellent. This practice adds to the cost as silica brick were very expensive in China up to the time those furnaces shut down.

Price of Furnace Brick (Japanese Brick Uscd).

Silica brick	20 gold cents each.
Magnesite brick	80 ,, ,, ,,
Chrome brick	40 ,, ,, ,,
Fire clay costs $25.00 gold per ton.	

Owing to the scarcity of cheap steel scrap in China, the open hearths at Hanyang are operated on about a 80 per cent. pig basis. Except in case of emergency, practically the only scrap used is that recovered from the pit and the rolling mills. Being so highly "pigged up," the furnaces operate much slower averaging when other things are all right, about two 30-ton heats per day. Figures during the last six years show the following ingot tonnage produced:—

1916...	43,104 tons.
1917...	60,933 ,,
1918...	25,146 ,,
1919 (Japan took pig)	4,850 ,,
1920...	50,912 ,,
1921...	46,800 ,,

Finished Steel Tonnage (Mostly Rails).

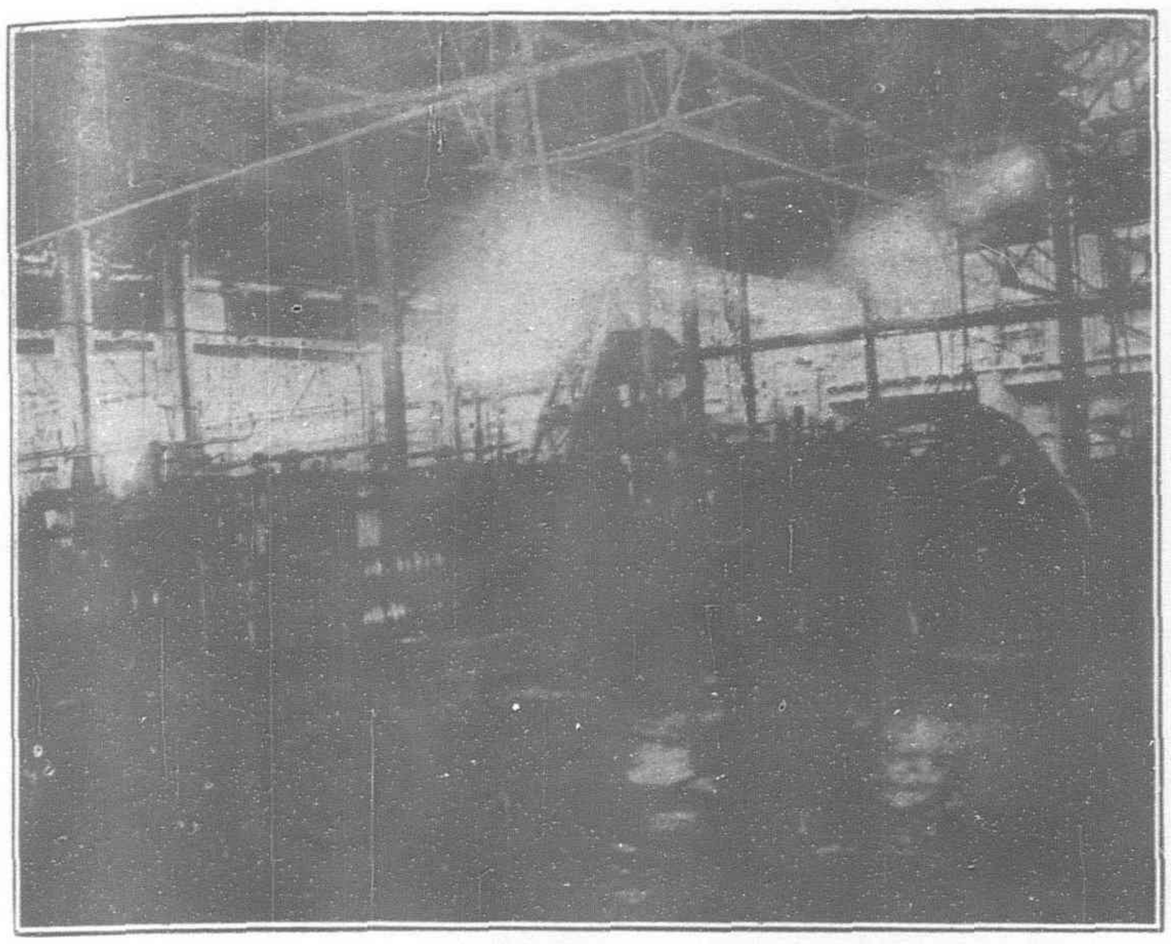
1916 (cold stock rolled)	45,043 ,,
1917...	42,651 ,,
1918 (cold heats charged)	26,994 ,,
1919 (pig sent to Japan)	3,684 ,,
1920...	38,260 ,,
1921...	35,100 ,,

Under prevailing operating conditions, the Hanyang plant is like a megaphone, with the blast furnaces at the big end. The furnaces provide more pig than open hearth needs (150,000 tons), the open hearth capacity is larger than the mill capacity and finally the mills produce more steel products than can be sold profitably under prevailing prices. Of course, pig iron can generally be sold to Japan at a price, but it seems poor foresight to have continued operating seven 30-ton open hearths spasmodically when two 75-ton furnaces could easily supply enough steel, allowing time for periodic relining too. This would save tons of gas coal and much labor per month, for instead of 18 gas producers, 6 modern producers would be sufficient.

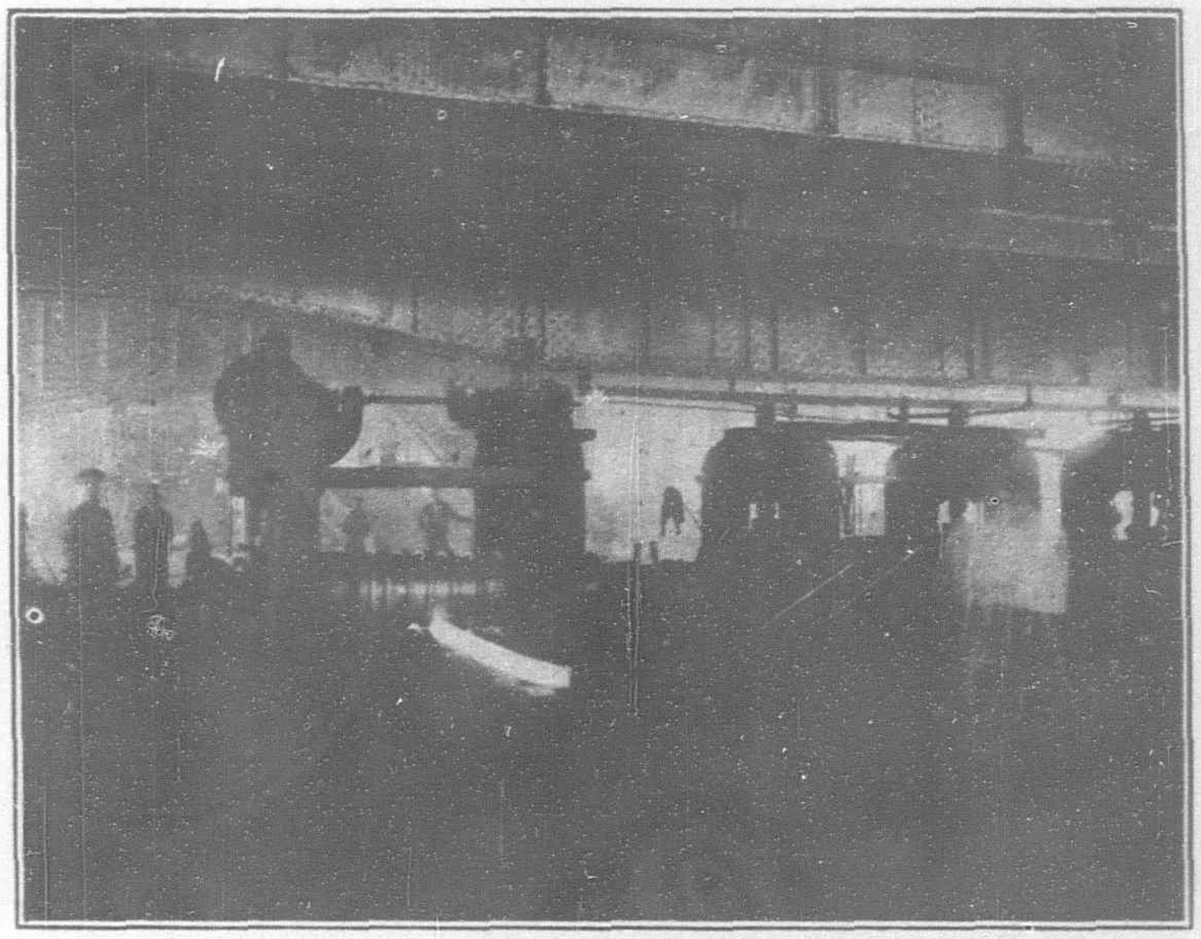
The furnace floor of the open hearth is served by two 35 ton-electric cranes and the charging boxes are handled by a Wellman charging machine. On the pit side of the building are two 50-ton ladle cranes, a poring platform and a hydraulic stripper.

The steel ingots are cast in moulds set on turtleback cars and when stripped are brought to the blooming mill soaking pits by locomotives. A charging crane (Wellman machine) places them in the heating pits. When set and reheated, the ingots are drawn and sent to the blooming mill. There is nothing unusual in the mill equipment, except that it would be considered obsolete in America, though perhaps not in Europe.

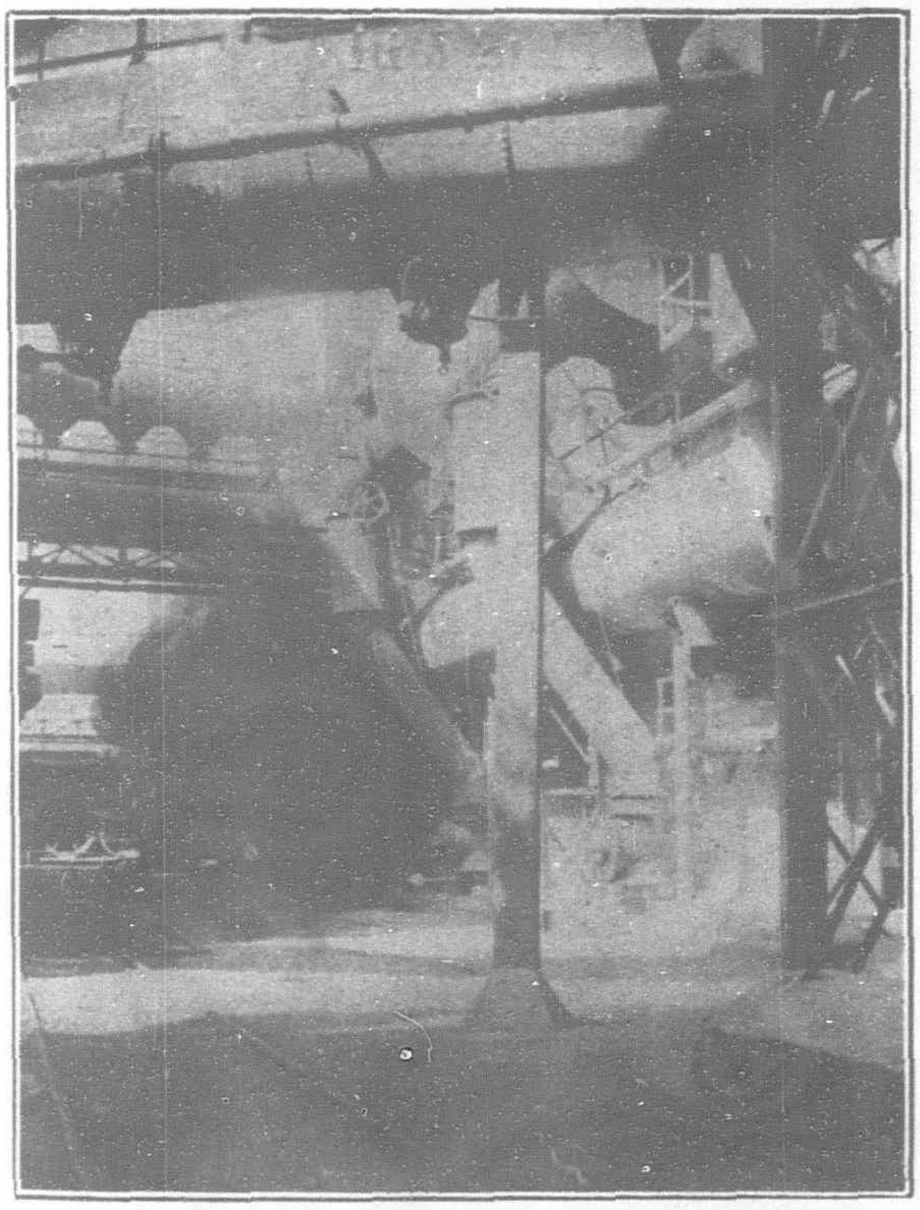
Although the 40-in. blooming mill and the 28-in. rail mill (used also as a structural mill) were only installed about 15 years ago, no one at the time seemed to have been cognizant of the continuous mill which in 1907 was quite common in the United States. The Hanyang blooming mill can "knock down" a four rail ingot into a bloom in fairly good time, but when the hydraulic shears have cut the bloom into 2 two railers, the delay is very noticeable. A four rail bloom (65-lbs. rail) is the easiest one to roll in American mills and tonnage piles up very rapidly, but in the two-high mill at the Hanyang Works, the fact that the bloom must be cut in two is a



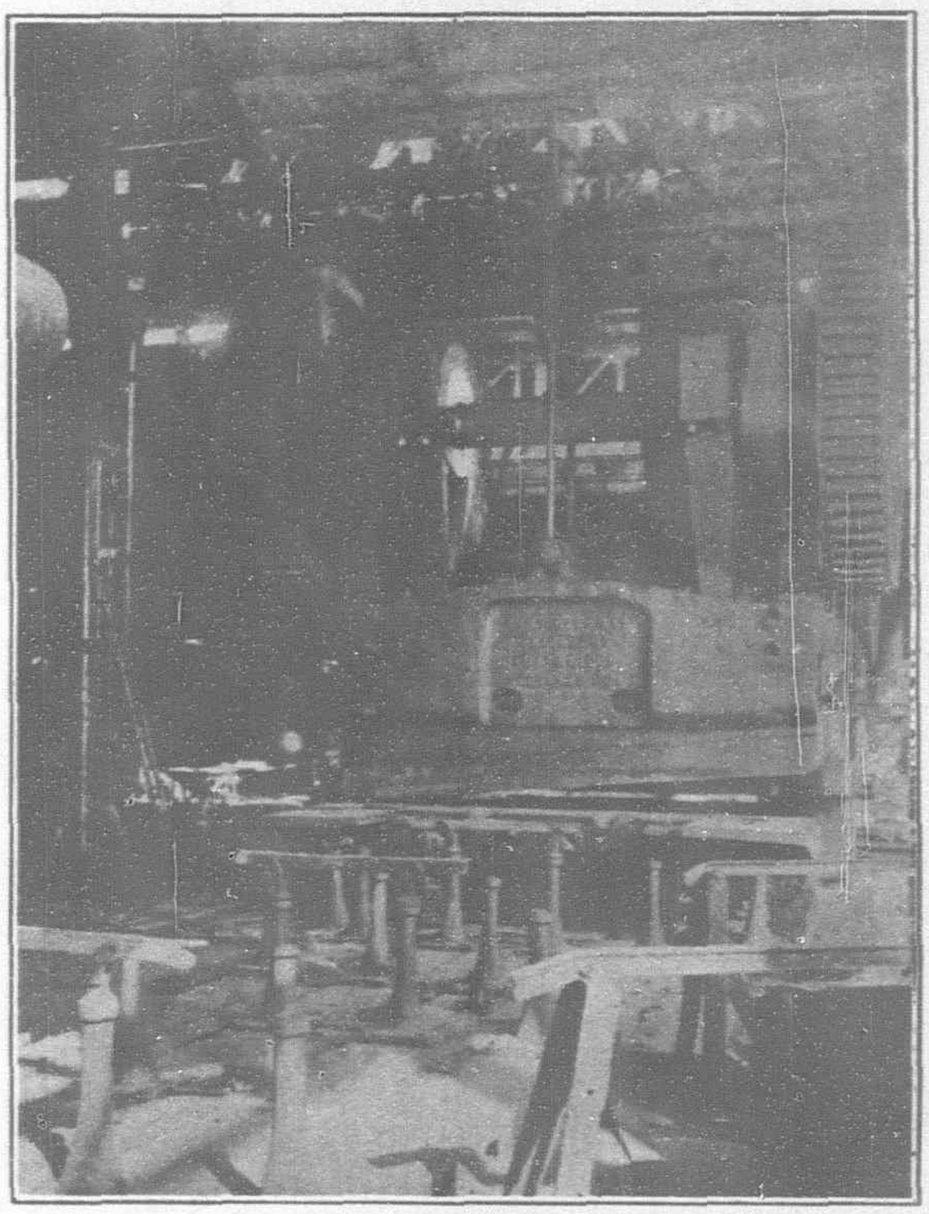
Bar Mill



Rail Mill

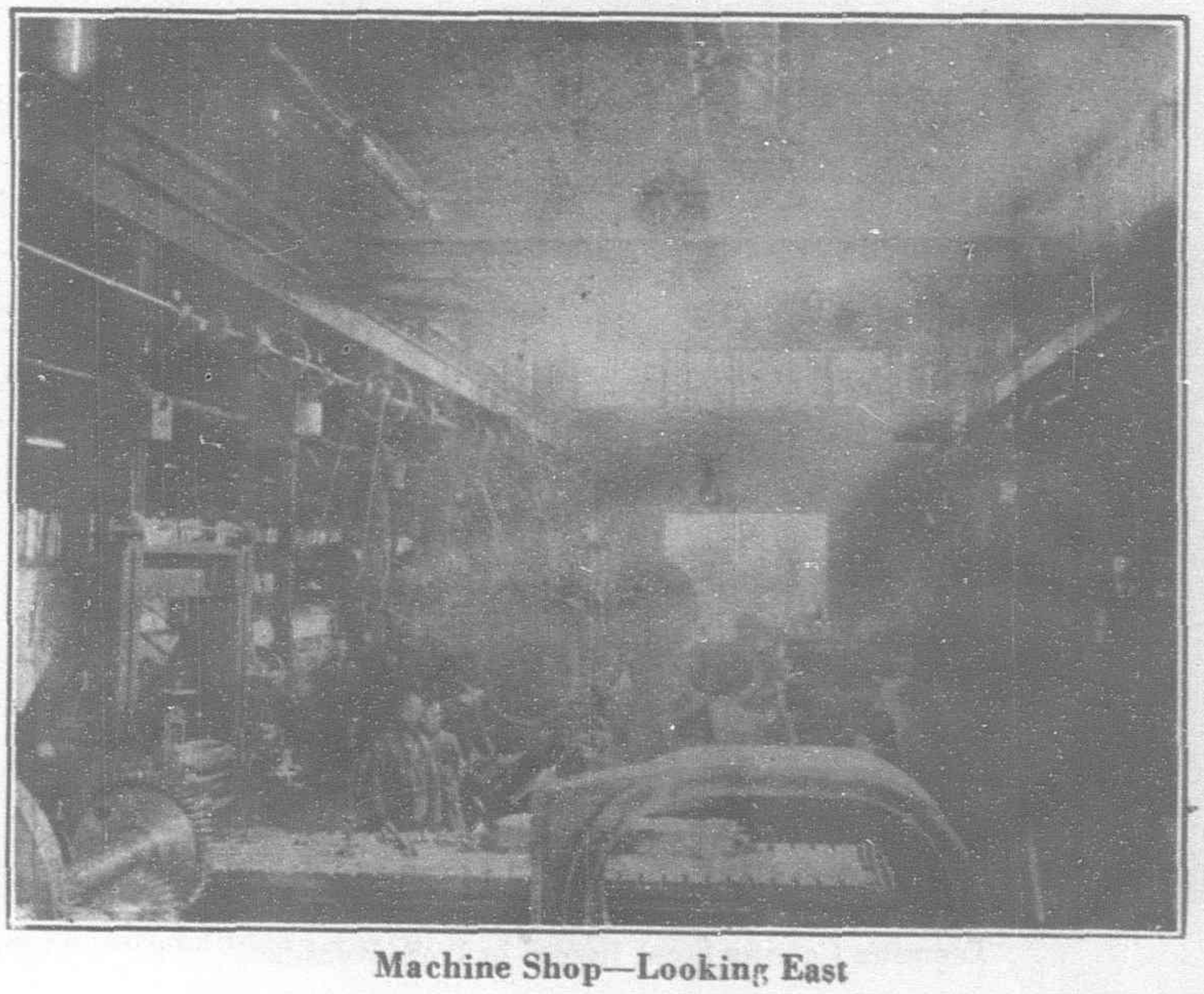


Valves, etc., of Hot Stoves of Furnaces 3 and 4

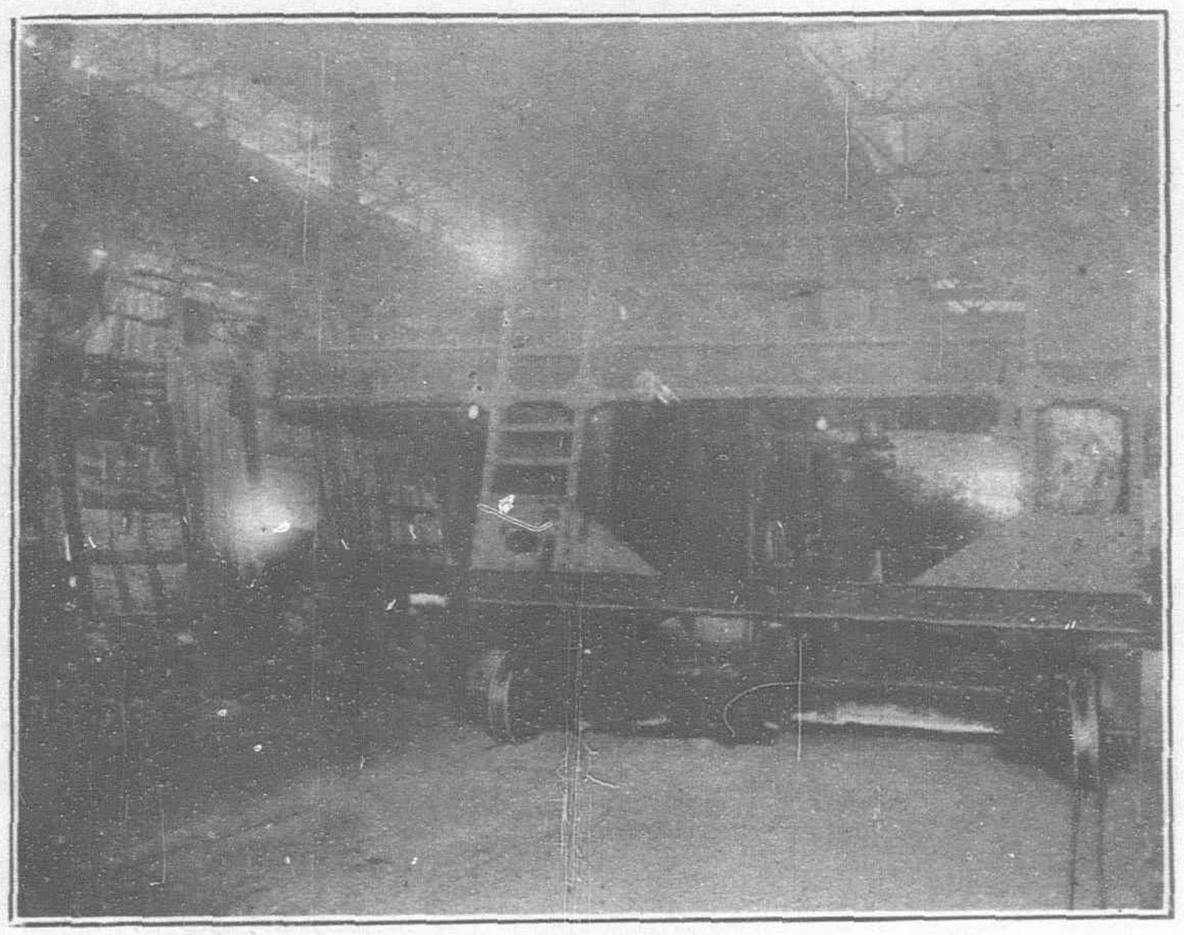


Electric Plate Shear

Electric Repair Shop



Machine Shop—Looking East



Charging an Open Hearth Furnace

Tapping an Open Hearth Furnace

very serious handicap. Costs start to rise at the 28-in. mill because both the first and second roughing as well as the finishing rolls are in line, i.e., in one train and naturally the second two railers cannot enter the first roughing rolls until after the first two railer enters the finishing pass. It would be slow enough even if the four rail bloom could be reeled direct from the blooming mill.

Owing to lack of room, this is impossible and all blooms are therefore cut and reheated before reaching the first roughing rolls. When working to capacity under these conditions, it is not surprising that but 120 tons of rails are rolled per day. The 28-in. mill (rail mill train) is driven by a 6,500 h.p. Davy engine. Another engine (Daniel Adamson) of 12,500 h.p. can be "hooked up" to the other end of the roll train when desired. The total weight of housings, couplings, pinions, rolls, etc., is fully as great (and the engine power too) as would be required in a continuous mill. The output is, however, but 25 per cent. of that possible in a continuous mill.

As the two railers leave the finishing pass they are rolled along to the hot saws (one electric, one steam) cut, and after going through the cambering machine reach the hot beds.

The straightening presses, drill presses and milling machines easily handle the product arriving from the hot beds.

Structural shapes up to 12-in. by 6-in. beams are also rolled on this 28-in. mill.

Plate Mill

In line with the blooming mill is the plate mill roll train driven by a 2,500 h.p. Davy engine. A roughing and a finishing set (two high) constitute this unit. A plate straightener set is in line with the finishing mill and is motor driven. This plate mill turns out plates from 2-ft. to 7-ft. wide and from 1-in. to $\frac{1}{4}$-in. thick.

Bar Mill and Light Rail Mill

A three high 16-in. bar mill is used for rolling fishplate, bars, etc.

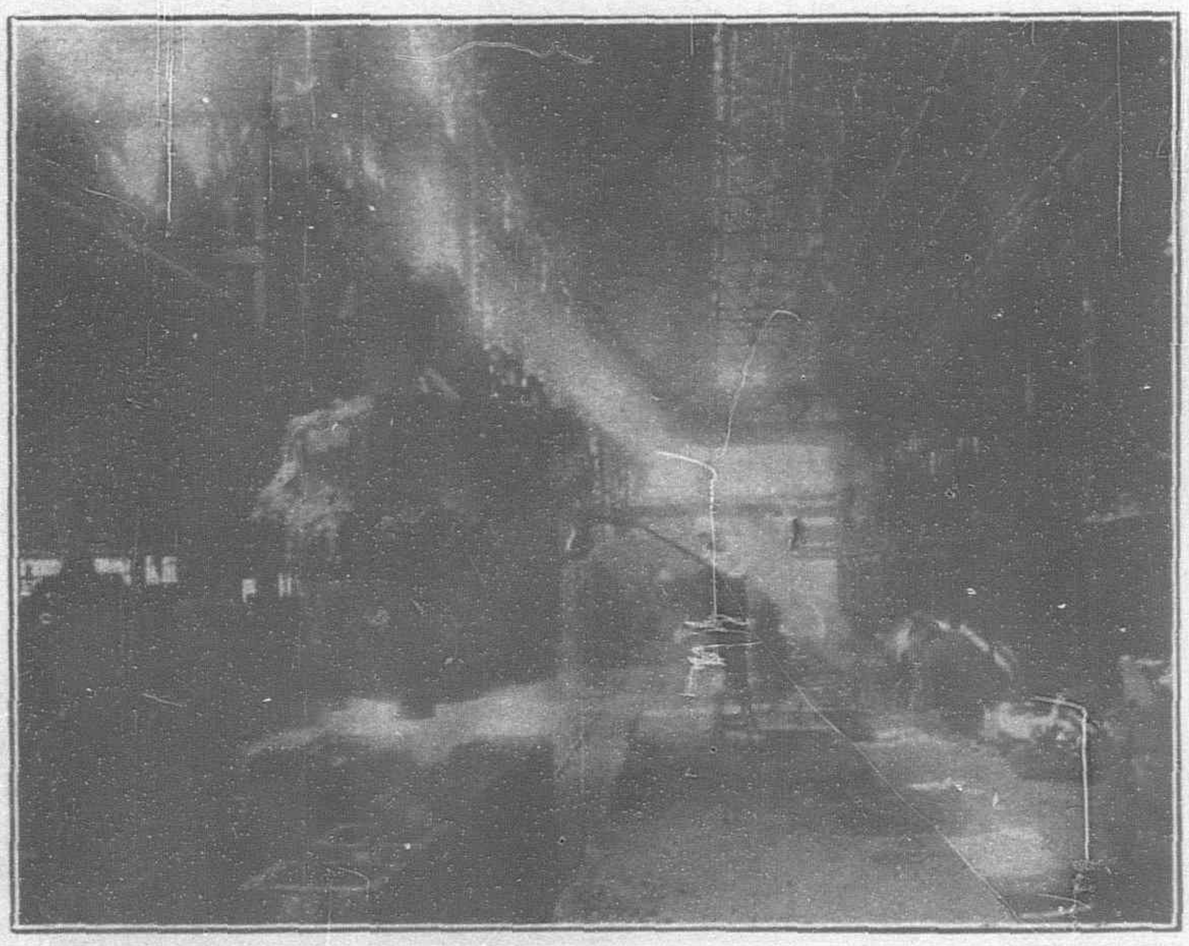
A light rail mill rolls from time to time rails under 30-lbs. per yard.

Nineteen coal fired Lancashire boilers supply steam to the big mills and eight Corinth boilers furnish power for the lighter mills.

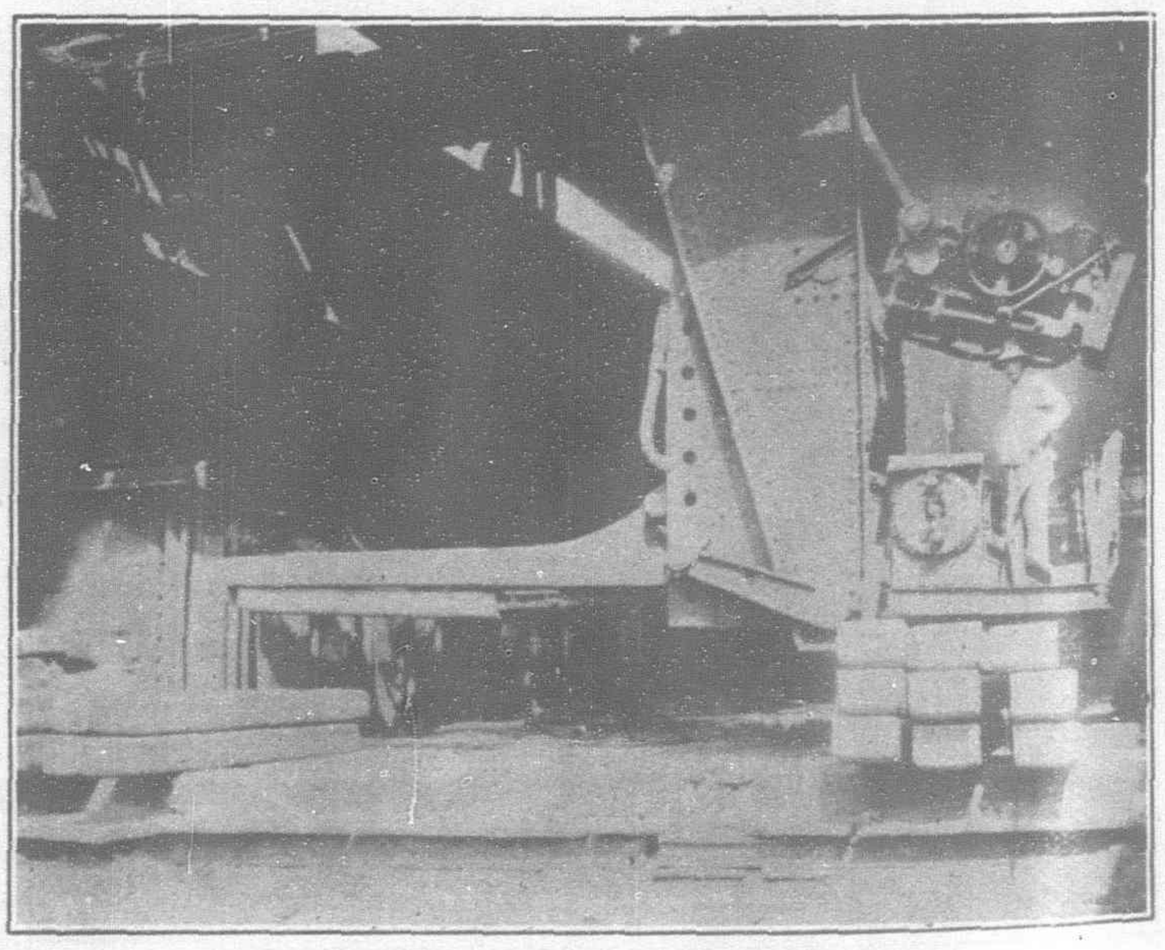
Finished Products

The products turned out by these mills are up to British standard specifications. The rails conform to a very severe drop test, which is practically the same as the British standard rail tests.

(1st) One piece of rail 6 feet long, taken from every 50 tons of rails manufactured will be placed on iron bearings 3 feet 6 inches



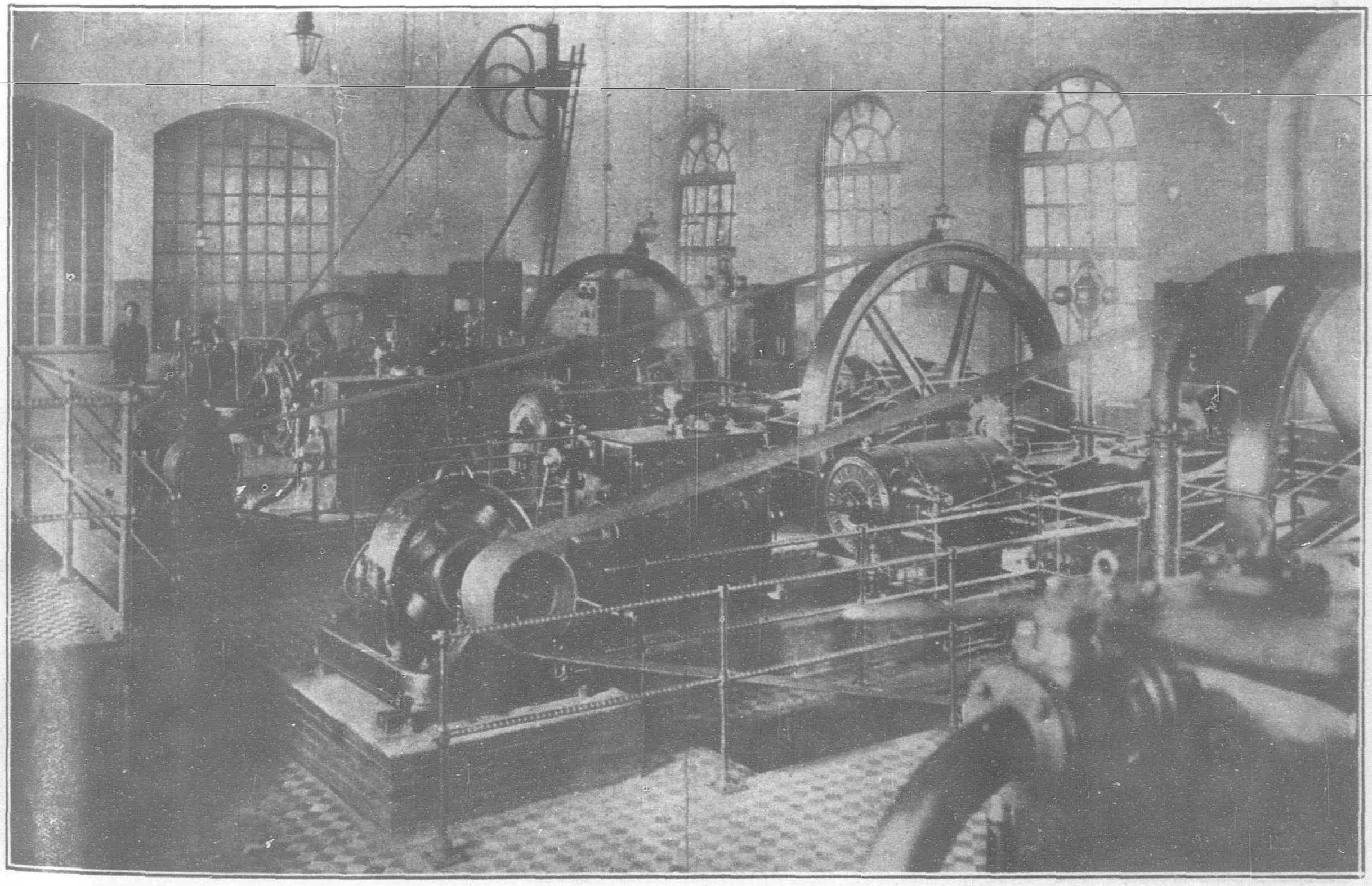
Teeming Casting Steel Ingots in Iron Moulds



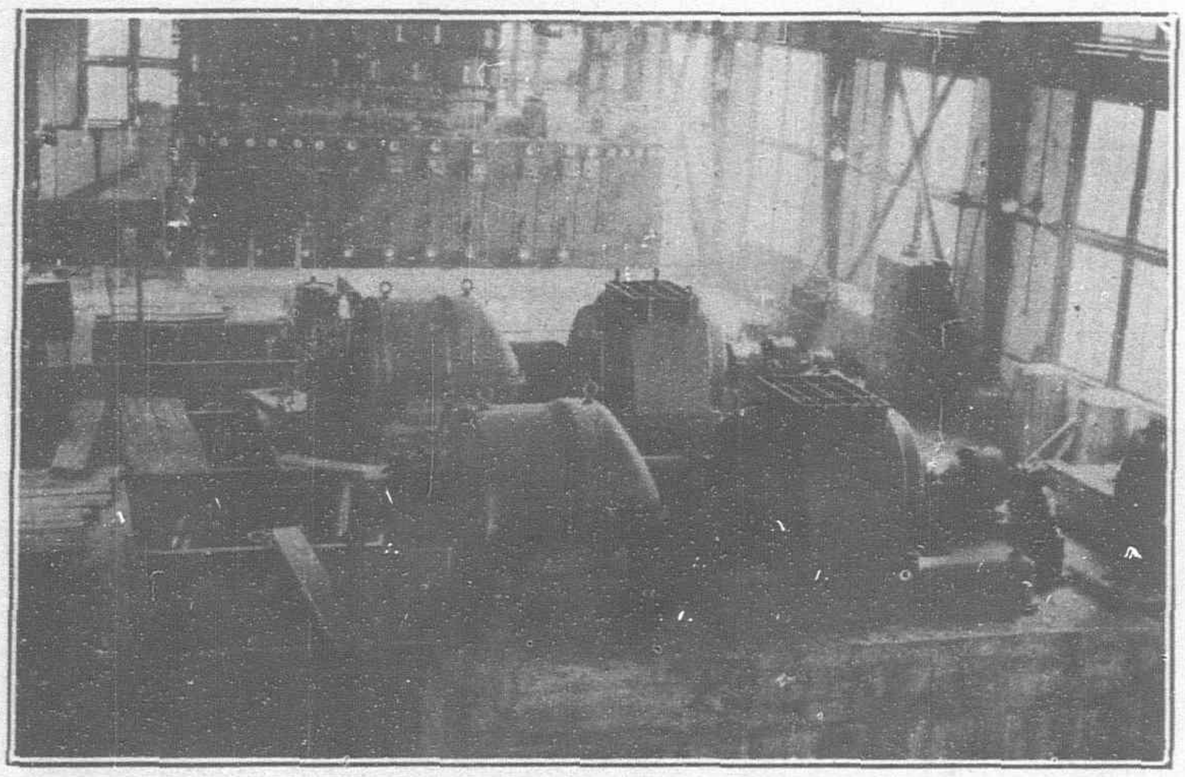
Bloom Charger

PINGHSIANG COLLIERIES OF THE HAN-YEH-PING COAL & IRON COMPANY

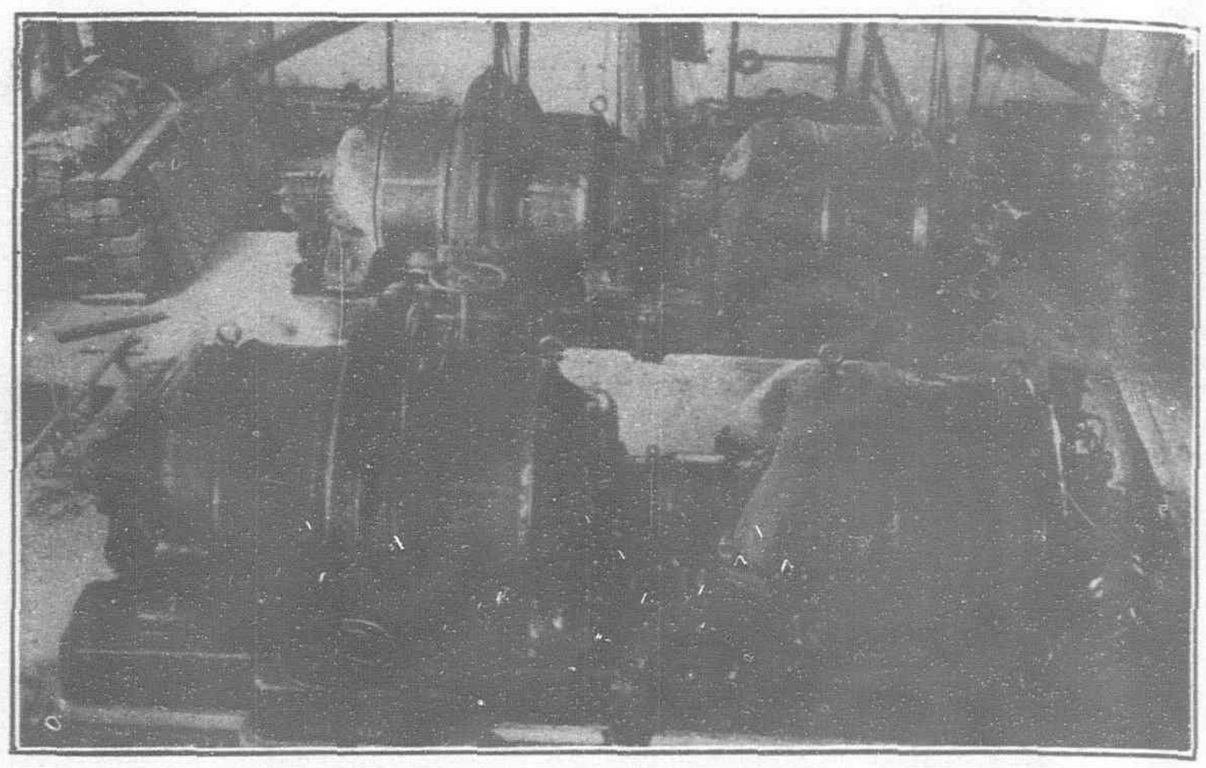
General View of the Pinghsiang Collieries of the Han-Yeh-Ping Iron and Coal Company, Located at Pinghsiang, Kiangsi Province



Power Room of the Pinghsiang Colliery equipped with German Machinery



Two Turbo-Alternators, each 1,500 k.w.



Two Turbo-Blowers, each 1,490 b.h.p.

A Fraser and Chalmers' Installation at the Tayeh Iron and Steel Works of the Han-Yeh-Ping Coal and Iron Company

apart in the clear, and equidistant from its ends, and a weight of 28 tons will be suspended from the centre of the rail. The deflection under this weight, measured on the distance between the centres of the bearings, must not exceed $\frac{5}{16}$ of an inch after the weight has been on the rail half-an-hour. No permanent set must appear after the removal of the load.

(2nd) The same piece of rail will be supported as before, and a cast iron monkey, weighing one ton, will be allowed to fall freely upon the centre of the rail from a height of 20 feet. The rail must bear two such blows without showing the least sign of fracture. Should the rail fail, then two more pieces from the same cast should be tried, and, if satisfactory, then the cast may be accepted. The permanent set caused by the first blow must not exceed 4 inches. The total deflection of the rail, measured on the distance between the centre of the bearings after both blows have been given must not exceed 8 inches. The rail is then to be broken by further blows; when it must show a perfectly sound and homogeneous fracture of such a character as shall be satisfactory to the inspector.

If any rail tested shall fail to comply with any of the above-named tests, the cast to which it belongs will be rejected, for which purpose every rail must have distinctly stamped upon it at both ends the number of the heat.

The writer has little criticism to make of the sections rolled. They conform pretty well to template. The chemical specifications are more liberal than in America, especially as regards sulphur and phosphorus. A spread of 20 points in carbon is also very liberal.

Pieces of rails must, on analysis, comply with the following:—

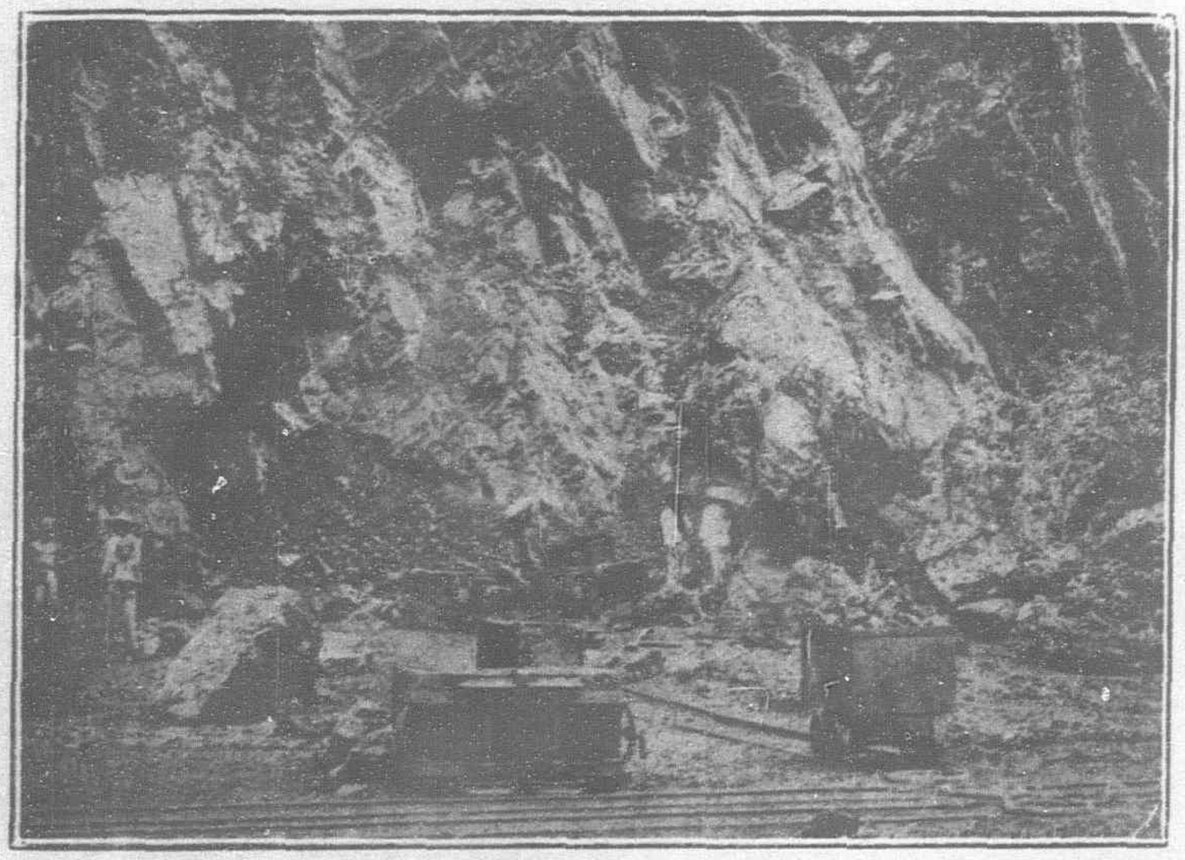
The quantity of	carbon	must not be	less than	0.40	per cent.
,, ,, ,,	,,	,, ,, ,,	more than	0.60	,, ,,
,, ,, ,,	Phosphorus	,, ,, ,, ,, ,,		0.075	,, ,,
,, ,, ,,	Sulphur	,, ,, ,, ,, ,,		0.06	,, ,,
,, ,, ,,	Silicon	,, ,, ,, ,, ,,		1.00	,, ,,
,, ,, ,,	Manganese	,, ,, ,, ,, ,,		0.90	,, ,,

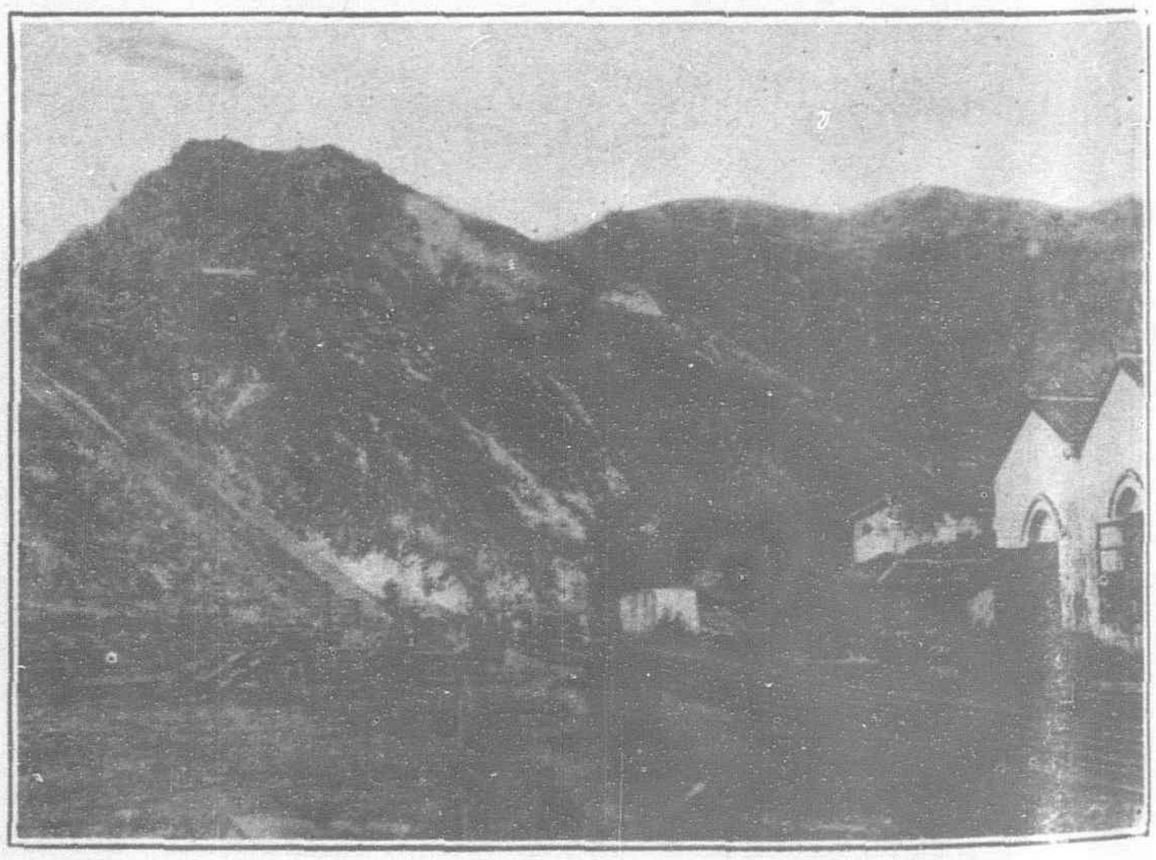
Should any piece of rail analysed not comply with these conditions, the cast from which it is taken shall be rejected and fresh samples taken from the remainder.

The standard rail used on many railways in China, orders for which have been placed with the Hanyang mills, is the 85-lbs. per yard Chinese section. This rail section is practically the same as the 8,504 section of the Illinois Steel Co., South Chicago. Certain radio are different and there is slightly less weight in the flange. The height and base are identical.

Conclusion (Hanyang Works)

The furnaces and mills described above constitute the main units of the Hanyang Iron and Steel Works. From a 1922 American standpoint not a single one of these units (with the possible exception of No. 3 and No. 4 blast furnaces) could be kept in operation. From the standpoint of efficient consumption of blast furnace output, the steel works are a failure and likewise the mills. From a tonnage standpoint alone these mills are an expensive luxury and the situation cannot be made better unless the open hearths and mills are scrapped and new mills (continuous rail and universal





TAYAH IRON MINES

plate) are erected at Tayeh, where there is plenty of room and good ground for foundations.

The Chinese management began to realize this last year and shut down all the mills and open hearth furnaces last November. It is almost certain that the present mills are considered obsolete by the management and there is little chance that they will ever make steel in any quantity again.

Figures on the cost of steel rails f.o.b. the plant are not officially available, but it is known through a very definite source that just before closing down the rail mill, Hanyang rails were costing not less than Taels 95 per ton, or at the present rate of exchange about $71 gold. Rails from the United States are selling c.i.f. Shanghai for $50 gold per ton, so the situation is very bad for the Hanyang product.

The primary reason why pig and steel costs are so high at the Hanyang plant of the Han-Yeh-Ping Co. is the excessively high cost of coke. Not only is coke very high in price due to costly transportation by rail and to rising coal mining charges, but it is also none too good in itself, because it is friable and high in ash and moisture. If the cost, however, could be substantially reduced on coke, the physical drawbacks could be withstood and a reasonable priced iron made.

Until coke is delivered at the furnace stock house at a cost approaching that in America, China will continue, as she is to-day, a country without a steel industry.

Coking Coal Properties of the Han-Yeh-Ping Iron and Coal Co. (Pingsiang Colliery)

The Pingsiang Colliery, a subsidiary of the Hanyehping Co., is the only source of supply for coal and coke this company owns. The deposits of coal are variously estimated at from 100 million to 300 million tons. All coal thus far mined cokes fairly well and there is every reason to believe that the rest of the deposits are of the coking bituminous kind.

Pingsiang lies 60 miles east of Chuchow, the junction point on the Canton-Hankow Railway. Chuchow is a city about 35 miles south of Changsha and almost 260 miles due south of Hankow, or rather Wuchang, the northern terminus of the Canton line. Wuchang is on the south bank of the Yangtze River directly opposite Hankow. The mines of the Pingsiang Colliery are five miles outside Pingsiang city, at a place called Anyuan, so that the total rail haul from the mines to the transhipping point at Wuchang is about 325 miles. This distance is not considered great in the United States, but in China costs of transportation over this length of line are most excessive and these coupled with the continued political disturbances in the provinces of Kiangse and Hunan are mainly responsible for the inability of the blast furnaces at Hankow to make pig iron at a profit. The high cost of coke prevents profitable operation in every part of China and Manchuria, and it is doubtful if this state of affairs can be corrected for at least a decade, except possibly in the Chihli district near Tientsin where efficient transportation both by hand and water can readily be made to bring down costs.

There are two mines opened at Anyuan, with a present total output of about 2,200 tons per day, or 800,000 tons yearly. Washing and cleaning reduce this to 640,000 tons. About 400,000 tons of this washed coal are used in the coke ovens and the balance is used for power purposes, either at the mines, on the railway, or at Hanyang itself.

Most of all bituminous coal found in China is, generally speaking, high in ash and sulphur and very friable. The Pingsiang field, however, is not too high in sulphur for pig smelting and in fact, this coal with the possible exception of the Kai Ping coal in Chihli province, is perhaps the best coking coal in China. The coke made from this coal is very much like the coke used in the successful operation of blast furnaces in India, where despite high ash and moisture cheap pig is made.

Analysis of Pingsiang Coal (Run of Mine).

Fixed carbon	54,118%
Volatile matter	23,490%
Combined water	1,392%
Ash	21,000%

In order to prepare this coal for efficient coke oven practice, two washing plants have been installed at the mines. One of these has a capacity of but 400 tons per day. The other is larger and more efficient and could take care of about 2,800 tons daily if the output of the mines increased.

The smaller of the two mines is worked in Chinese fashion, the Company dealing with contractors who get so much a ton for washed coal having ash under 15 per cent. The company, however, furnishes the pumps to keep the mine dry and in certain places, where the workings are deeper than is usual, with the Chinese safety devices and ventilating arrangements are provided.

The large mine is opened by a long haulage way, or adit, nearly two miles long. A short adit connects with a vertical working shaft and also a ventilating shaft. These shafts are circular ones about 14 feet in diameter and extend to a depth of 800 feet. In the main passages, or adits, electric locomotives draw out the loaded cars. The rock in the mine is hard limestone, with many strata of shale and slate, as well as a large amount of clay partings in the coal seams themselves. There are two grades of coal found, a hard and a soft bituminous. The hard variety is found in small seams from 6 inches to 30 inches in thickness. In mining this coal, considerable quantities of slate have to be taken out. These hard bituminous seams are mined by the ordinary long-wall method, in which the entries are run with the dip, and along the strike, and all the coal is extracted while advancing. The soft bituminous coal is also mined in this way. There are six seams of soft coal varying in thickness from 10 feet to 40 feet. Drifts are run for ventilating purposes every 60 or 80 feet along the haulage way and connection made about 250 feet distant from the main gangways to provide the air circulation. In the thickest seams blocks 10 feet in thickness are removed, and while the roof is supported with timbers, the open space is filled with waste. Then the second cut is proceeded with. Timber costs are excessive owing to this method of working.

The coal output (run of mine) during the last six years was as follows :—

1916...	...	992,494 tons.	1919...	...	794,999 tons.
1917...	...	946,080 ,,	1920...	...	824,500 ,,
1918...	...	694,433 ,,	1921...	...	700,000 ,, (about).

Deducting 20 per cent. from the average run of mine output to take care of loss in weight due to washing, the average annual production of coal fit for commercial purposes is about 640,000 tons.

Most of this washed coal is made into coke either in the native or non-recovery retort ovens. The retort ovens are 262 in number and resemble the evince coffee type. The coking efficiency of these ovens is not great, and the time consumed per charge to turn out coke is 48 hours. The average daily output of these foreign batteries (allowing for relining) is not over 350 tons. Supplementing these retort ovens are a large number of native rectangular Chinese ovens, varying in number according to the coal available for coking. These ovens furnish the bulk of the coke made, averaging, all told, about 150,000 tons per year.

The output of coke at Pingsiang Colliery during the last six years was as follows :

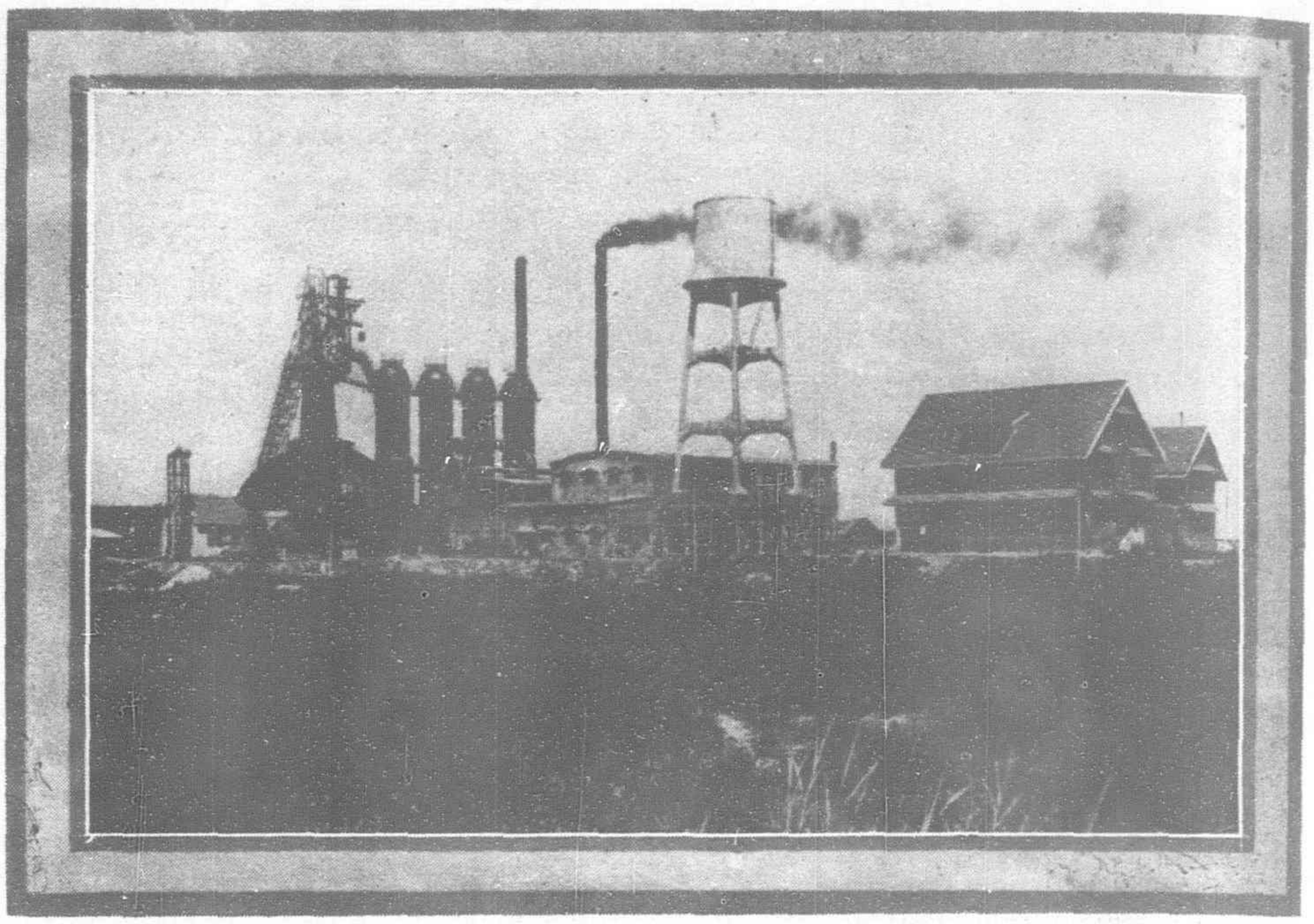
1916...	...	266,418 tons.	1919...	...	249,015 tons.
1917...	...	239,797 ,,	1920...	...	263,000 ,,
1918...	...	216,013 ,,	1921...	...	250,000 ,, (estimate).

Analysis of Pingsiang Coal and Coke.

	Foundry Coke	Smelting Coke	Navy Coal	Washed Coal	Run-of Mine Coal
Analysis in the Crucible.					
Fixed carbon	87.941	88.060	60.167	59.921	54.118
Volatile	—	—	30.290	24.240	23.490
Combined water	1.119	0.840	1.953	1.149	1.392
Ash	10.940	11.100	7.590	14.690	21.000

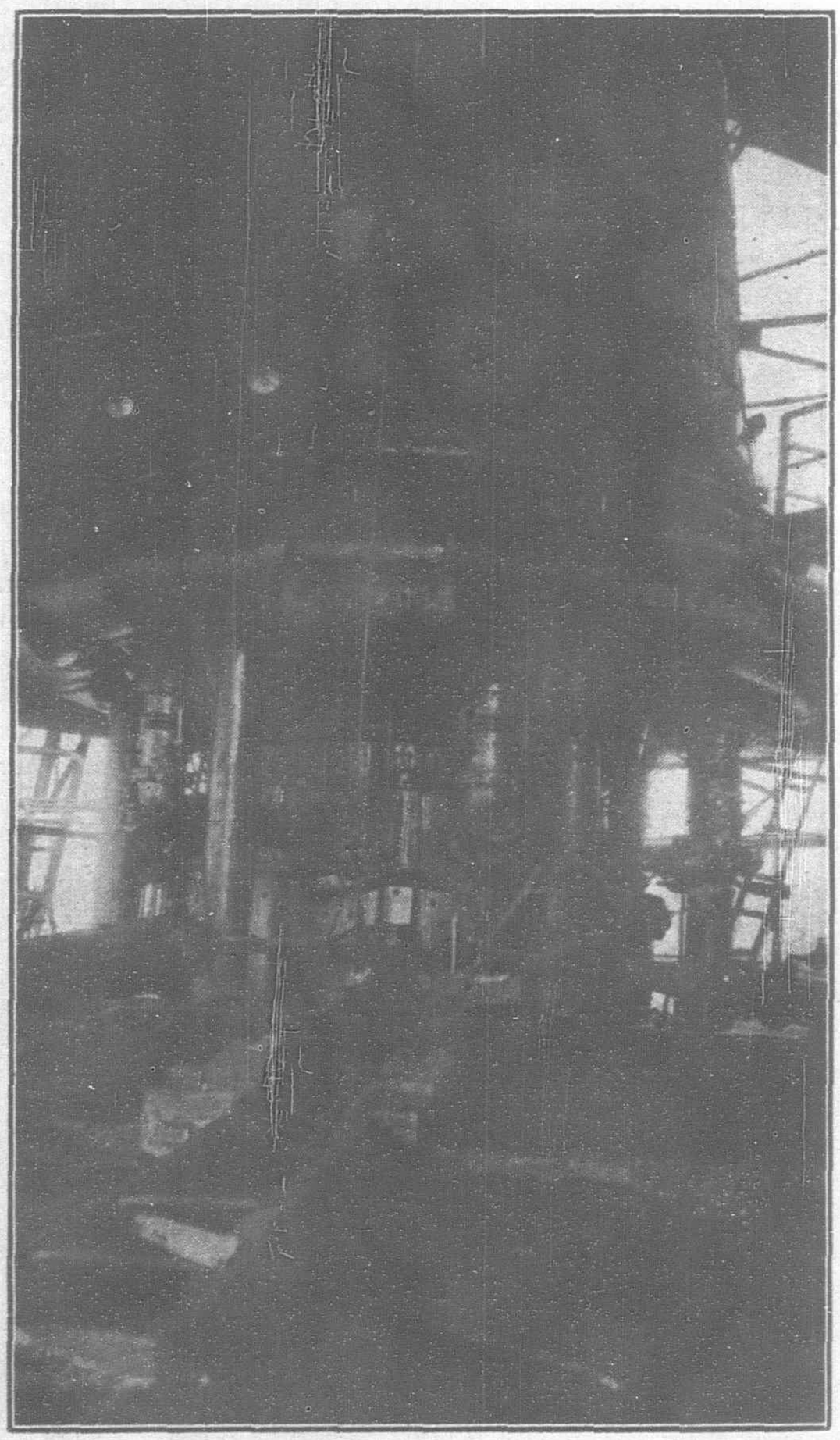
Analysis of Pingsiang Coal and Coke.

	Foundry Coke	Smelting Coke	Navy Coal	Washed Coal	Run-of Mine Coal
		Elementary Analysis.			
Carbon	83.520	84.252	79.239	75.330	70.758
Hydrogen	1.067	0.744	5.099	4.891	4.012
Sulphur	0.506	0.618	0.547	0.522	0.527
Oxygen	1.833	1.480	4.102	2.241	1.107
Nitrogen	1.015	0.966	1.470	1.169	1.204
Hygr. water	1.119	0.840	1.953	1.149	1.392
Ash	10.940	11.100	7.590	14.690	21.000
		Analysis of the Ash.			
Silica	62.040	60.820	49.040	60.520	65.700
Alumina	26.360	27.640	25.690	24.979	24.890
Oxide of iron	5.960	6.100	16.430	3.840	3.770
Lime	3.410	3.200	5.340	6.340	2.860
Magnesia	1.770	1.850	2.800	3.400	2.220
		Melting Point of the Ash.			
The ash is melted at oC.	1350	1450	1200	1250	1355
		Heating Power and Evaporation Efficiency.			
Capacity of heat (Cal.)	6977	6962	7690	7402	6815
Quantity of steam at 100° C. produced by 1 kg. of Pingsiang coal from water at Oo (kg.).			12.07	11.62	10.69

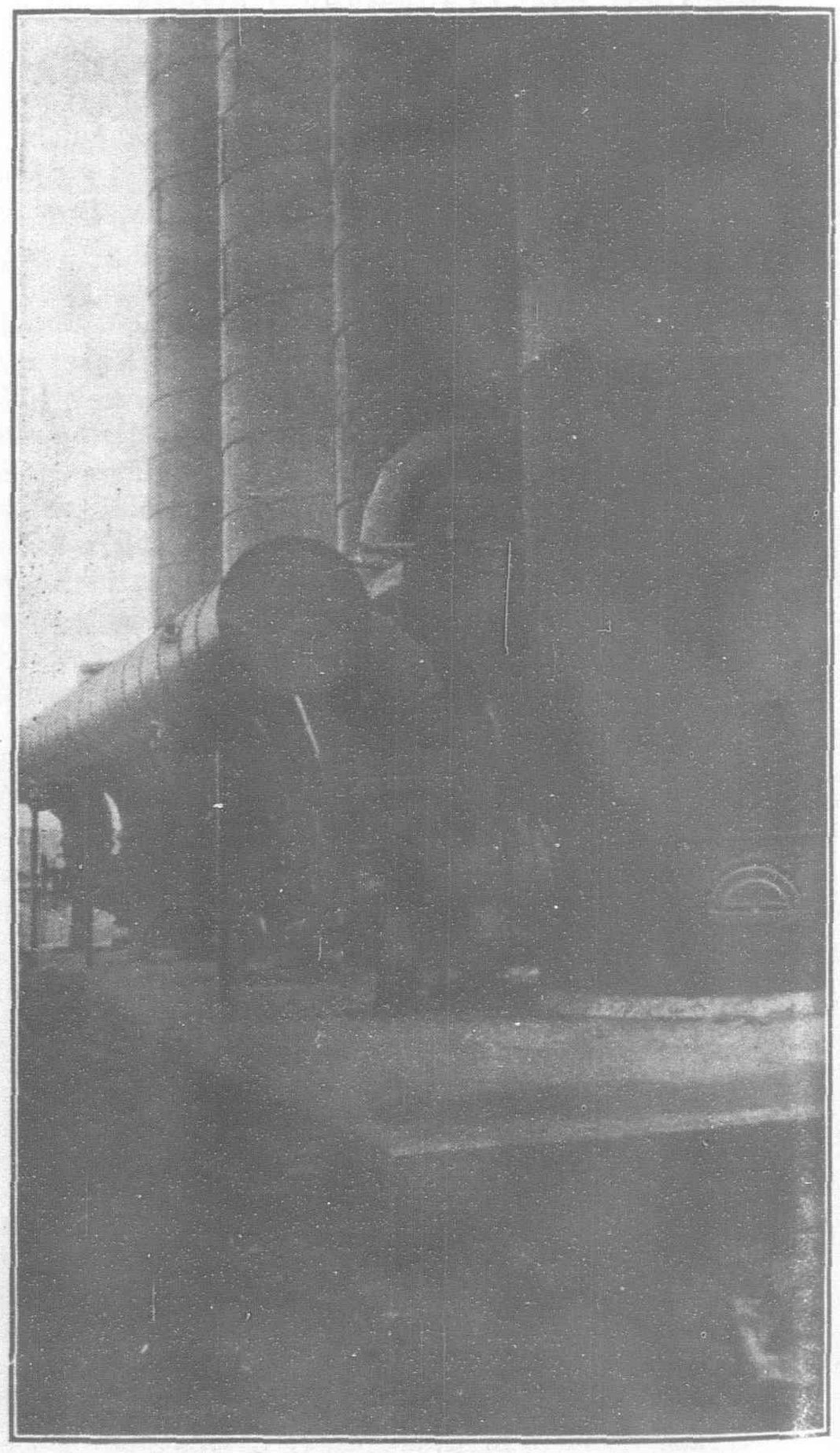


General View of Blast Furnace, Yangtsze Engineering Works, Ltd., Hankow

In addition to the mines, washing plants, and coke ovens, the Pingsiang Colliery operates a large machine and bridge shops Work is done in fabricating steel bridges for the Peking-Hankow Railway at Pingsiang. An iron foundry is also operated to supply spare castings for the various undertakings. Repairs are also made on the locomotives and cars employed on the main line railway.



The Bell Furnace



Hot Stoves and Chimney Valves

YANGTSZE ENGINEERING WORKS, LTD.

The power house installation consists of one 600 k w. generator, which is now being discarded, as two new 1,500 k.w. turbo-generator. are ready to operate. With the new 3,000 k.w. plant, all mine extensions contemplated can be taken care of.

As stated above, the net average output of coking coal is about 640,000 tons. The efficiency of the coke ovens is low and in order to make the average annual coke tonnage of 250,000 tons, 400,000 tons of coal are required. This is a showing of but between 60 per cent. and 65 per cent. The coal not used at the ovens is sold to the Canton-Hankow Railway and the Hanyang Iron Works for boiler purposes.

It is very difficult to get accurate figures on the cost of coke delivered at the blast furnaces at Hanyang, 325 miles by rail from Pingsiang. There are a great many items entering into this cost which are not constant. Under circumstances prevailing at the present time, however, this cost may be stated to be $14.00 gold per ton. This is a very high figure compared with coke costs in America, but this total is made up of charges all along the line, from coal seam to stock house, which could be to a large extent reduced through increased production and efficiency.

Run of mine coal at the pit mouth costs $2.00 gold per ton. 20 per cent. must be added for loss in weight by washing and another 5 per cent. for washing cost. Coal at coke oven then costs $2.50 gold per ton.

It takes 1.6 tons of coal to make one ton of coke, and this cost of material plus conversion charges, brings the cost ex-oven to about $6.00 gold per ton of coke. Loading charges at Anyuan, railway freight to Wuchang, reloading into lighters at Yangtze River, and the final unloading at Hanyang all these steps bring the cost at blast furnaces to $14.00 gold.

The biggest item in the above transportation costs is naturally the freight over the 320-mile haul. This is variously estimated to be between $5.00 and $6.00 gold, as the railway is almost entirely supported by the traffic from Pingsiang. This railway, in fact, belonged to the Yanyehping Company at one time, and was taken over by the government as a part of the Canton-Hankow Railway. The line from Chuchow south to a point 150 miles north of Canton, must be built before there is any possibility of increased traffic lessening the load carried at present by the coke leaving Pingsiang for Hankow.

Another factor adding to the high cost is the lack of water near the mines. All water must be brought from a point at least five miles from the pits, and as there is no reservoir built to hold what water is needed, this process is very expensive as well as inadequate. A reservoir is, however, being planned to secure water supply. Inefficiency is very noticeable all along the line, and labor conditions are very critical as well.

The Tayeh Iron Mines of the Han-Yeh-Ping Iron and Coal Company, Ltd., China

(By Lansing W. Hoyt, Trade Commissioner, Shanghai, China.)

ARTICLE III

The Tayeh mines are located about 65 miles down the Yangtze River from Hankow near a town called Hangshihkang. They lie about 15 miles inland from the south bank of the river and are reached by a standard gauge railway owned by the company. This railway when first built (the curves have now been taken out to a large extent) was unfit for the haulage of any large tonnage of ore because it was necessary to avoid graves dotting the country, and this made a very crooked line. This railway was built in 1891 by Viceroy Chang, but even he had to listen to the protests of the native Chinese, who feared to disturb the graves of their ancestors. This short railway was the second one built in China. During recent years the superstitions of the local Chinese in regard to the graves have been overcome through money payments, and the line has been straightened.

There are four locomotives and 56 "battleship" ore cars in service. The locomotives were supplied by the American Locomotive Company and the ore cars by the American Car and Foundry Co.

The Tayeh properties were known to the medical Chinese and large dumps of slag containing 30 or 40 per cent. iron are monuments to the crude reduction methods employed during the Sung Dynasty, about 1,000 A.D. The Chinese have been scratching these ore fields ever since but it was not until the Hangyang Iron and Steel Works was started in 1891, that any attempt was made to mine iron ore on a large scale. For a number of years, however, even this company tock out less than 48,000 tons annually. During the last 15 years, the output has steadily increased and in 1920, 824,000 tons were mined and shipped. 1921 figures show approximately 800,000 tons mined.

The main ore vein lies in a range of hills rising some 300 or 400 feet above level of the railway line. It is about 200 feet thick and rises almost perpendicularly between limestone and diorite (rock). Conservative estimates place the ore tonnage in sight at about 35,000,000 tons. The matallic iron content varies slightly, depending somewhat on its proximity to the limestone contact. It is a rich haematite and the run of mine ore will show 58 per cent. iron. The property is now being worked at three points, the principle workings being at Tienshan and Te-Tan-Wun where electrical sub-stations have been installed in an attempt to reduce costs and increase production by getting away from the old hand methods and dependency on expensive and unreliable coolie labor. Two large air compressors and a large number of Ingersoll-Rand pneumatic drills 75 (jackhammers) are on the ground but as yet have not been put into regular service, because the power line is not ready. The method up to the present has been the old quarry system of stripping the vein and then blasting the ore. The loaded ore cars are carried along inclines by gravity to the railway loading platforms where by means of hoppers the ore is dumped into main line cars and despatched to the Yangtze River docks or to the Tayeh furnace stock house.

Tayeh Ore Analysis.

Fe	...	...	...	59.45	per cent.
Mn	...	...	...	.63	" "
S	...	...	...	.319	" "
P	...	...	...	.109	" "
Al O	...	...	...	1.05	" "
Cu	...	...	...	.292	" "
Si O	...	...	...	9.16	" "

Tayeh ore is the best iron ore in China and acts very well in the Hanyang furnaces at Hankow (but so far, not at the new Tayeh furnaces). On account of its proximity to the Yangtze River, this mine is also one of the chief sources of Japanese ore supply. Japan annually takes between 250,000 and 500,000 tons of Tayeh ore in addition to a large quantity of Hanyang pig. Under a loan agreement (1913, backed by treaty, 1918) the Japanese are entitled to ore and pig at a price fixed each year, the pig iron figure being based on a Cleveland base price. The 1913 loan from Japanese interests (others have been made subsequently) provides that within forty years the principle and interest are to be paid in ore, pig, and to some extent in steel. No steel, however, is likely to be sent in payment, for the Hanyang mills are an expensive luxury and so obsolete that they can never be run at a profit again. In time rolling mills may be erected at the Tayeh property on the Yangtze River near the mines, but even this is problematical, unless somebody steps in with new money. Under the loan agreement, it is definitely stipulated that during the period of the loan the Han-Yeh-Ping Co. must sell a total of 15,000,000 tons of high-grade ore from the Tayeh mines to Japanese blast furnaces, exclusive of tonnage already contracted for. In this connection it is further stipulated that two tons of ore are to be sold to Japanese interests for every ton consumed by the Han-Yeh-Ping furnaces. It was also agreed that commencing in 1919 the total tonnage of ore despatched to Japan, should be annually augmented by 50,000 tons, until the total going to Japan would be 500,000 tons yearly. When conditions in the iron and steel market were better, Japan took all but 45,000 tons of the pig output of the Han-Yeh-Ping

Company. At present this company is making about 150,000 tons per year ; so that Japan has been taking about 100,000 tons. It is reported, however, that owing to the depression in steel, Japan is not pressing for all the tonnage in ore and pig that she is entitled to. A price of $21 gold was originally stipulated (1913), as the amount to be credited on the loan for each ton of pig iron shipped. Owing, however, to the enormous rise in costs in all departments of the Han-Yeh-Ping Co., a compromise was arranged and the amount credited is based annually, as pointed out above, on the price of Cleveland (England) pig. Even, allowing for this more favorable arrangement, the price at which iron is delivered (and ore too) is below the cost of production.

There is no ore bridge at the river and of the Tayeh railway line and all iron ore despatched to Japan is loaded by coolie labor. It was expected that the electric power line running from the Han-Yeh-Ping power house on the Yangtze River to the Tayeh Mines would be in operation during 1922. While the lack of this electric power has seriously effected the output of ore at the mines, neverthelese the Chinese management explain this delay by stating that Japan is not taking much ore and there is plenty for the Han-yang furnaces. As a matter of fact, however, the real reason is that the Tayeh furnaces and improvements at the mines have taken all the liquid capital of the Han-Yeh-Ping Company, and owing to the disastrous inefficiency with which the new 450-ton Tayeh furnaces have been operated, the consumption of ore was necessarily curtailed. It is true that coolie labor can supply enough ore for the two blast furnaces now in operation at Hankow.

The cost of Tayeh ore delivered at furnace stock house (all charges included such as interest, etc.) is G. $2.82 per ton. This is not excessive, but by sufficient management and improved methods, this cost could be materially reduced.

Conclusion

The Tayeh ore mines, containing as they still do, over 35 million tons of high-grade ore, are the greatest asset the Han-Yeh-Ping Co. has, and in reality are its only good collateral for a loan. If it became necessary to do so, the creditors could shut down the furnaces entirely and through efficient mining operations could easily pay off all obligations. The accessibility of the Tayeh mines and the high quality of the ore, coupled with its workability in the blast furnace, places the Tayeh properties in good potition potentially at least. If a railway were built from the Pinghsiang Collieries (only 180 miles south as the crow flies) direct to the Tayeh blast furnaces, all transhipment and lighterage charges as well as delays on coke would be stopped and Tayeh iron, and even steel, could be made at a price to compete throughout the orient. There is, however, very little chance of a direct line being built in the near future, and for this reason Tayeh pig iron can be considered out of the commercial markets of the east for some time to come.

The Tayeh Blast Furnaces, China

Han-Yeh-Ping Iron & Coal Co., Ltd.

The two new " stacks " recently erected on the Yangtze River about 65 miles east of Hankow are called the Tayeh (pronounced Ta Yay) furnaces. With the exception of the blast furnace (Langyen) near Peking, these two " stacks " are the newest in China. Their *rated* capacity is 450 tons of pig each per day, or a combined yearly output of about 325,000 tons. These blast furnaces were planned during 1915 and in fact the order for their erection was given at that time. Owing to the world war, however, the necessary expert licences for material could not be readily obtained and actual work at the site did not start in earnest until 1918.

A small town was laid out and built to house the more important members of the working force. There is a club-house placed at the disposal of foremen, superintendents and others of the organization who hold responsible positions. The town, itself, is well arranged, and the streets are paved.

The blast furnace plant is contiguous to the town, being just east of it on a large well graded plot of ground adjourning the Yangtze River. There is plenty of room for expansion should steel mills be added later on. The office buildings are well built as are the brick shed, machine shop, iron foundry and laboratory.

The furnaces, themselves, stand on well-made concrete foundations, the hearth jackets being about 18 feet above the railway track level. The area immediately about the two stacks is surrounded by concrete retaining walls and filled to hearth level with sand. The surface about the hearth is paved with brick. There is no cast house, in the strict sense of the word, as it was considered better to handle all iron in hot metal ladles and carry it a few hundred yards to a special pig-casting house where it is poured and allowed to cool. There is no pig-machine, however, this building being merely a detached cast-house containing the sand pig beds to receive the hot metal. When the blast furnaces are working properly, this arrangement has some advantages, because it keeps the area about the furnaces clean and there is less heat to contend with during the hot weather. The disadvantages of devorcing the cast house from the furnace are apparent, however, during a "breakout" when perhaps a ladle is not at hand or cannot be placed to receive the metal. Then, too this method increases the percentage of scrap metal because of more ladle " skulls " and runner scrap.

Between, and slightly to the rear of the furnace, is a water tank for granulating slag. At present, however, this is not being used as all the slag is run into ladles and carried to the dump. The slag volume on all furnaces in China is necessarily large owing to the high ash coke and the heavier stone charge needed to get the required analysis.

The charging system employed is that known as the " bucket " system. Many authorities consider that the bucket distributes the charge more evenly, but whether this be true or not, it would have been better to rely (in China at least) on the old reliable skip-hoist arrangement. There are many experimental features (from a Chinese standpoint) about the Tayeh plant and due to inexperienced or inefficient construction at the site, many of these features have been responsible in part for the present disastrous state of affairs prevailing at Tayeh.

The furnaces themselves were designed ny Dr. M. Oshima (deceased), technical adviser of the Han-Yeh-Ping Co. up to the time of his death a year ago. Dr. Oshima had been adviser on metallurgical subjects in Japan and was long connected with the Imperial Japanese Steel Works. After a thorough investigation of various types of furnaces in all parts of the world, he designed the present Tayeh "studio" and ordered them built in the Riter-Conley shops in Pittsburg.

When " A " furnace was ready the concrete water tanks collapsed, and orders were given to " blow in " anyway, pumping the water direct to the furnace. This, of course, was poor judgment as on erratic supply of water was the result. Bnt it cannot be claimed that this was the main reason for the enforced shut down.

On July 4th it became evident that the bell was not closing tightly and that due to the excessive heat resulting the operating arrangements at the furnace top were not working properly. Several attempts were made to adjust the machinery, but the heat unnerved the Chinese and nothing seemingly could be done to remedy matters. This condition became more aggravated until finally the loss of gas effected the temperature of the stoves and this drop in temperature coupled with a loss in pressure soon began to be felt below the mantle. First one tuyere was lost and then another, until only two were left. Finally the entire furnace was lost and the charge froze up. When sufficiently cold, the iron was blasted out and arrangements are now being made to re-line.

" B " furnace will shortly be " blown in " and it is hoped that the experience gained on " A " will enable all the weak points in construction and operation on " B " to be overcome.

The above is a sad commentary on blast furnace operation on what appeared to be the most modern blast furnaces in the world. Evidently someone had blundered. Some people in China are not of the opinion that a 450-ton furnace will never work well here, because

the coke is too friable and the burden pressure too great. The successfully operated furnaces at Hankow are hand filled and of 250 tons capacity. Undoubtedly a smaller furnace is less intricate and its operation more familiar to the Chinese now running blast furnaces in China.

The Tayeh furnaces and plant cost Mex. $8,000,000 when a silver dollar (Mex.) was equal in value to a gold dollar. Even at the present rate of exchange the investment is close to $5,000,000 gold.

Common labor at Tayeh receives between 20 cents and 30 cents Mex. (silver) per day. Skilled labor receives from 50 cents to $1.00 Mex.

Conclusion

While the writer is not pretending to be an authority on Chinese blast furnace practice, nevertheless he feels that he has a right to express an opinion regarding Tayeh practice because he has talked with those operating tde plant and has been present at a time when one of the furnaces was working so badly. It must not be lost sight of, that the coke used at Tayeh is very high in ash and friable. It must also be noted that Tayeh iron ore is quite refractory, resembling magnetite in this respect. The furnace, the operation of which was so short lived, is larger than any others in China or India and would ordinarily carry a heavy burden. The fact that the heat of combustion, however, was not in the proper zone—it being above the hearth to a considerable extent—prevents the carrying of a heavy burden. In addition to this the refractory nature of the ore makes for a higher top temperature too. With the zone of fusion away from the hearth and the burden lighter than expected, it was only natural that the top should become too hot for efficient working and that the temperature of the hearth should be materially reduced.

This reduction of the hearth temperature coupled with the loss of gas at the top and loss of wind pressure, invitably led to the shut down. (Ed. "B" furnace was successfully "blown in" April 1st and now producing more than 300 tons per day.) Let us hope that the Chinese management and their advisers have learned enough through costly experiment on "A" furnace, to insure efficiency when the "wind" is turned on "E."

Blast Furnace of the Yangtsze Engineering Company—Hankow, China

The Yangtsze Engineering Company's blast furnace is the only furnace in the Hankow district not belonging to the Han-Yeh-Ping Iron & Coal Co. It is a small stack with at rated daily output of 100 tons. The design is American (Perin & Marshall) and in every respect this furnace is quite as modern as any of the larger blast furnaces in China. The foundation work was commenced in January 1919 and owing to the world demand for such material as was needed in this plant's construction, a great deal of the equipment was made at the shops of the Yangtsze Engineering Co., the Chinese concern that furnished the capital for this enterprise. Even the brick for the lining was manufactured at the Kailan Mining Company's kilns near Tientsin. This lining, however, did not stand up well under operation and a lining sent out from the United States would have been more satisfactory and less costly in the long run.

The furnace is supported by six cast iron columns. There are six tuyeres to deliver the blast and the cooling arrangements for the bosh are as simple as possible. Just above the tuyeres is one row of copper bosh plates but no cooling plates are used above the mantle. The upper part of the furnace is protected against hot spots by a spray to be used in case of emergency.

The furnace top is the stationary double bell type. A single skip hoist serves the furnace, the buggy being operated by power from two horizontal hoisting engines with 12-in. high pressure cylinders.

The usual blast furnace dust catcher is supplemented by a centrifugal whirler for thoroughly cleaning the gas before it passes to the stores and boilers.

The skip hoist buggy is hand filled below, no arrangements for modern stock-house equipment having been considered necessary. The cast house is ample for the tonnage produced, the pig being carried away by coolie labor after hand breaking. The cast house frame work is light and the roof is made of galvanized sheets.

There are two horizontal compound blowing engines and one tandem compound engine. The power end of these engines was purchased in America, but the "wind" end was manufactured, after an Allis Chalmers design, at the local plant of the Yangtsze Engineering Works. The air from the in-take in drawn through two cylindrical tanks which are arranged and cooled on the principle of a surface condenser. It is doubtful, however, if this air chilling device is very effective. It is not expensive, however, and cannot be expected to approximate results obtained in a refrigerated dry blast layout.

The boiler house contains four water-tube boilers, each of 1,500 sq. ft. heating surface and 150-lbs. pressure. Two Weir pumps are installed for boiler feed and two horizontal Worthington pumps for service. Boiler feed water is heated by the exhaust steam of the service pumps.

The water supply for the whole plant flows from a settling tank through an 18-in. cement main and is pumped to the concrete water reservoir which has a capacity of 80,000 gallons.

The Yangtsze furnace was built during the period of extreme inflation, when iron was selling in China for G. $80 per ton or more. It is a well designed stack and the Chinese who supplied the money were anxious to take immediate advantage of the prosperity prevailing in the iron business in China during 1915. The company owns neither coal properties nor ore mines and it is dependent on others for raw materials. Coking coal properties (Liu Ho Kou) several hundred miles north on the Peking-Hankow line supply the coke and the iron comes from mines along the Yangtsze River principally from the Hupeh mining bureau's properties near the Tayeh iron mines only 60 miles from the furnace.

Analysis of Liu Ho Kou Coke

Water	2.00 per cent.
Volatile matter	1.54 „ „
Fixed carbon	75.60 „ „
Ash	20.66 „ „
Sulphur	0.41 „ „

The iron ore is of good quality (See Tayeh analysis) but the coke is very friable and high in ash.

The Yangtze furnace was "blown in" on June 26, 1920, just at the time that iron prices in China began to crumble. From a metallurgical standpoint the furnace acted well and the only criticism of the plant itself, is that the furnace is too small for efficient operation from the standpoint of costs. It is also very difficult to profitably operate a furnace that has no direct control over its raw materials and which is at the mercy of Chinese provincial officials when it comes to the transportation of coke. The political trouble in and about the Hankow district have made it impossible to operate this furnace with any degree of certainty because the coke supply due to political disturbances was unreliable and the cost of same, consequently, very high. In December, 1920, the actual cash costs of raw material per ton of pig were :—

Iron ore	G.$ 4.93
Ma. ore	.16
Limestone	.42
Coke	13.73
Total ...	G.$19.24

The above figures of course do not include labor, stock handling charges, depreciation office expenses nor interest. The furnace made during December, 1920, 2,446 tons of pig, so it can be readily seen that with so small a tonnage, the overhead, etc., would add tremendously to the cost per ton. Materials and direct labor alone at that time showed a cost per ton of G. $22.40. After this costs continued to rise and prices continued to drop, so that in March 1921 the furnace was "blown out" as it could not be profitably operated. At the present time, it is estimated that, all charges

considered, it would cost, at least $55.00 gold per ton to make iron. The present selling price of pig at Hankow is less than this figure, because there is little local consumption and iron has to be sold on a C.I.D. Shanghai basis. The Japanese are the arbiters of price on locally made pig iron and now that their market is overstocked and many of their open-hearth furnaces shut down, there is not enough business to go around. American pig could be landed, in Japan under present conditions, at a price to undersell Hankow.

Perhaps when military chiefs and provincial governors begin to see things from a national instead of a local standpoint, transportation will not be interfered with and raw material costs will come down to a basis that will permit the Yangtze furnace to compete in the Far Eastern iron markets. There is no immediate prospect of such a change taking place, however, and it is doubtful whether this furnace will ever be a factor at Hankow until it controls its own raw materials.

(*To be continued*)

HAMMERING THE LOAN

(*Continued from page 304*)

The latest issue of the British chamber of commerce *Journal* makes no reference to any condemnatory resolutions in regard to the loan. It could not consistently do this, as British investors created the precedent of lending money to Japan for Manchurian development purposes.

The local Chinese chamber of commerce has passed no resolution concerning the loan, in fact, they know little or nothing about it, and seem to care less.

American co-operation for the advancement of national interests in China can never be successful so long as a handful of anti-Japanese propagandists are able to influence American policy in this country and intimidate people at home to accepting their viewpoint. It is a sorry spectacle when the greatest American financial institution, with its immense affiliations in China and close understanding with the state department is to be brought to task and admonished for its audacity in breaking away from the established program of the anti-Japanese coterie who for so many years have terrorized other Americans into endorsing their lop-sided views.

It goes without saying that when the National City Bank, or one of its subsidiaries with its immense Standard Oil holdings, enters into a transaction with a Japanese corporation for a loan to be devoted to Korean development, that every phase of the deal has been carefully scrutinized by the state department as well as by the financiers themselves. Common sense should tell Americans in China, that when American financiers decide to co-operate with Japan for such development, that it constitutes the surest guarantee that Japan has abandoned her old militaristic projects and is standing solidly with their own government for the preservation of principles which now typify Japanese as well as American policies towards China. The mere fact that American money is to be loaned to Japan for these purposes carries the assurance that China's interests are fully safeguarded.

Manufacture of Tin Plate in India

The Tinplate Co. of India (Ltd.), which is said to have one of the most modernly equipped plants of its kind in existence, commenced operations in its factory at Golmuri near Jamshedpur during December. The company expects to supply sheets for the manufacture of kerosene, cigarette, and other tins for which there is a big demand in India. Plates will be rolled ranging in thickness from one-eighth inch to one-quarter inch and in widths up to approximately 96 inches. The mill has a capacity of 3,000 tons per month on an eight-hour day and will come into full commission as soon as the new open-hearth furnace of the Tata Co. is ready to supply steel ingots for rolling.

ELECTRICAL DEVELOPMENT IN TAIWAN

(*Continued from page 323*)

The president and the vice-president are appointed by the governor-general of Taiwan. The president was formerly the chief of the central research laboratory. The vice-president is the chief of the department of civil engineering of the government general; Mr. Ogoshi is an engineer, Mr. Nagata is the chief of the Mitsui branch office in Taiwan. Mr. Takata has been for many years in the government service in Formosa. The vice-president acts as general manager, while Mr. Ogoshi is chief of construction, and Mr. Nagato is the business manager of the company.

Other Companies

THE TAIWAN DENKI KOGYO K.K. (Taiwan Electric Industry Co., Ltd.) is a sister company of the Taiwan Denryoku K.K. It is capitalized at Y.2,775,000, all paid up. It has business offices at Giron, Rato and Suwo, and supplies lights and power to the Taiwan Denryoku K.K., and operates an ice plant. The property of this company was purchased in September, 1921 from the Giran Denki K.K., and it confined its efforts to the generation of power by steam. But since June, 1922, it has been producing power both by steam and water, its Tensohi power plant having been completed in May, 1922 It recently purchased the carbide mill of the Taiwan Kogyo K.K.

This is a new concern, and much of its funds are being used in construction work. Its profits are not yet large. It is evident though that it will be amalgamated with the Taiwan Denryoku K.K. The demand for ice is growing and the future of this concern in all directions looks bright. The president of the company is the vice-president of the Taiwan Denryoku K.K., Mr. G. Sumi. The directors are K. Ito, M. Tanaka, H. Nagat, T. Maki, Y. Komatsu, S. Asafu and I. Sakai. The auditors, K. Watanabe, K. Kawakami and T. Yamamoto.

TAIWAN GODO DENKI K.K.—This company was organized in August, 1920 to take over the business of five companies including the Toen Denki K.K. It is capitalized at Y.5,160,000, of which one-quarter is paid up. Its head office is at Toengai, Shinchiku-shu, Taiwan, with branches at Toen, Chikunan, Sansha, Sekishako, Bokushigai, Bakogai and Taitogai. It produces 280 k.w. from gas, 320 by steam, and 1,350 k.w. by water power. Most of the hydro-electric power is supplied to the Taiwan Denryoku K.K., through its Taichu branch. The Taiwan Godo Denki K.K. has lost some business in lights recently, but has increased its power supply. Profits of 7 per cent. have been earned, but if the sugar business continues active, this company will greatly increase its profits.

The president is Mr. S. Suzuki, who was acting chief of the forestry department of the government general. The managing-director is W. Sugino. The directors and auditors are: T. Kaku, T. Kawai, H. Watanabe, R. Kan, Y. Obata, Z. Akutagawa, R. Rim, T. Konishi, N. Sasaki, H. Ko, U. Kamitaki, E. Ide, Y. Okuma, T. Tanaka.

SHINCHIKU DENTO K.K.—The Shinchiku Electric Light Co. was established in May, 1912, capitalized at Y.500,000, of which Y.410,000 is paid up. It has loans outstanding amounting to Y.300,000. It generates power by steam, 50 k.w., and 200 k.w. from its hydro-electric plant. Is supplies 12,600 electric lights, but about a third of the power it uses is supplied by the Taiwan Denryoku K.K. It also operates an ice plant with a capacity of five tons a day. All its enterprises have been successful financially and the company pays dividends of 10 per cent. per annum. The officials are: President and Director: E. Nagano; Directors: T. Maki and G. Sakuse; Auditors: R. Nihara and K. Tei; Manager: T. Funabashi.

Electrical Development in Taiwan

A Super-Power Scheme to Supply the Island of Formosa

THE first electric enterprise in Taiwan was organized in 1902 to supply light to the city of Taihoku. The government, however, nationalised the industry because of its great importance to the development of the island as an industrial centre and in the following year took over the enterprise and constructed the first power plant at Kizan on the upper reaches of the Shinten-kei. This plant, producing 660 h.p. was completed in 1905, and later expanded to 1,000 h.p. transmitting the power to Taihoku, the capital. In 1907, construction of a second power plant of 3,000 h.p. was commenced at Shoso-ko, on the same river, and was completed in 1909.

The government then decided that electric enterprises in the south and central portions of the island should be linked up with its schemes for irrigation and drainage. In 1909, a power plant generating 2,000 h.p. was constructed at Chikushimon, located to the east of Kizangai, in the central part of the island, and the power transmitted to Tainan and Takao. In the same year, a new power plant was started at Kori, on the left bank of the River Daiankei, in Taichu province, generating 1,200 h.p. which was completed in 1911.

Head Office of the Taiwan Electric Power Company, Ltd., at Taihoku, Taiwan (Formosa)

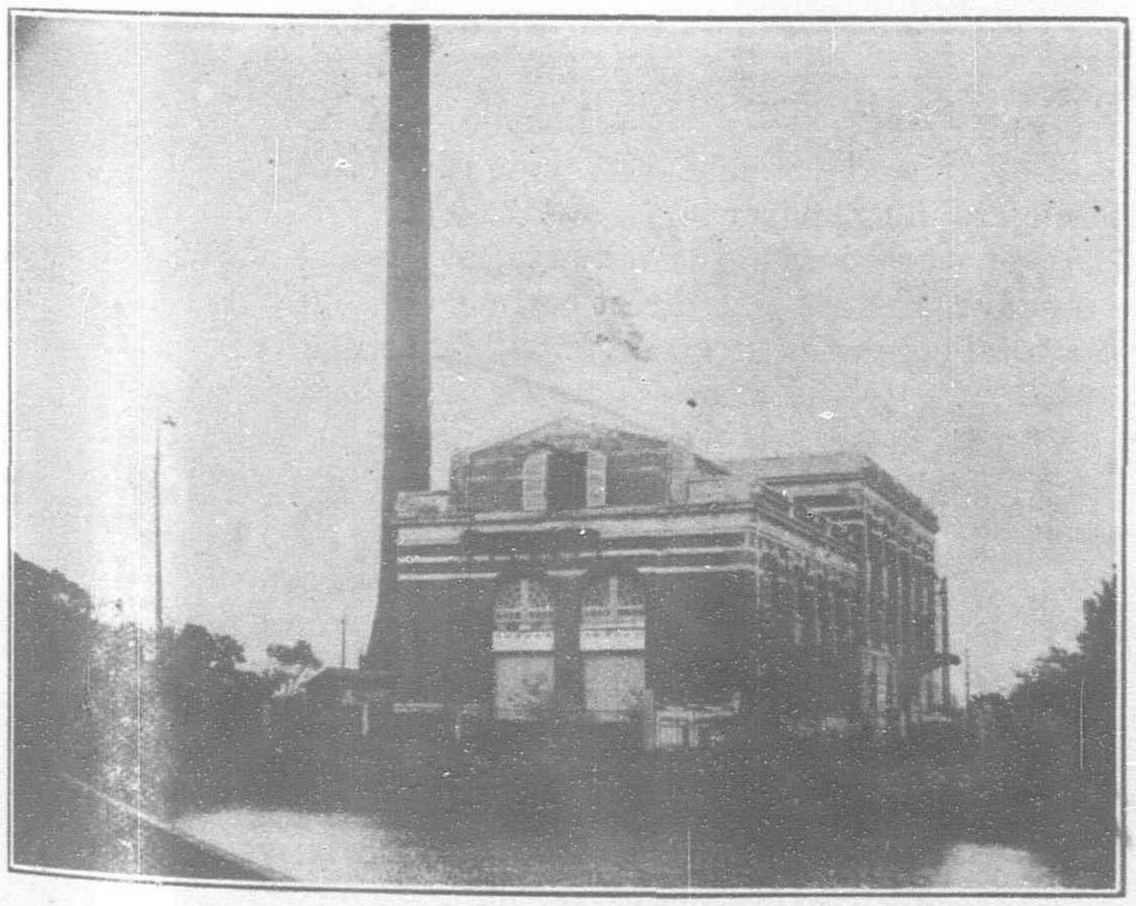
In 1917, the Toryuwan plant was completed, generating 4,000 h.p. to supply Takao and Tainan. All these enterprises were at first under the direct control of the extraordinary engineering department of the Taiwan government general, but were later placed under the department of civil engineering. In July, 1919, when the Taiwan Denryoku K.K. (Taiwan Electric Power Co., Ltd.) was organized all the government enterprises were transferred to its control and in this manner all the electric enterprises in Formosa came again into the hands of private enterprise.

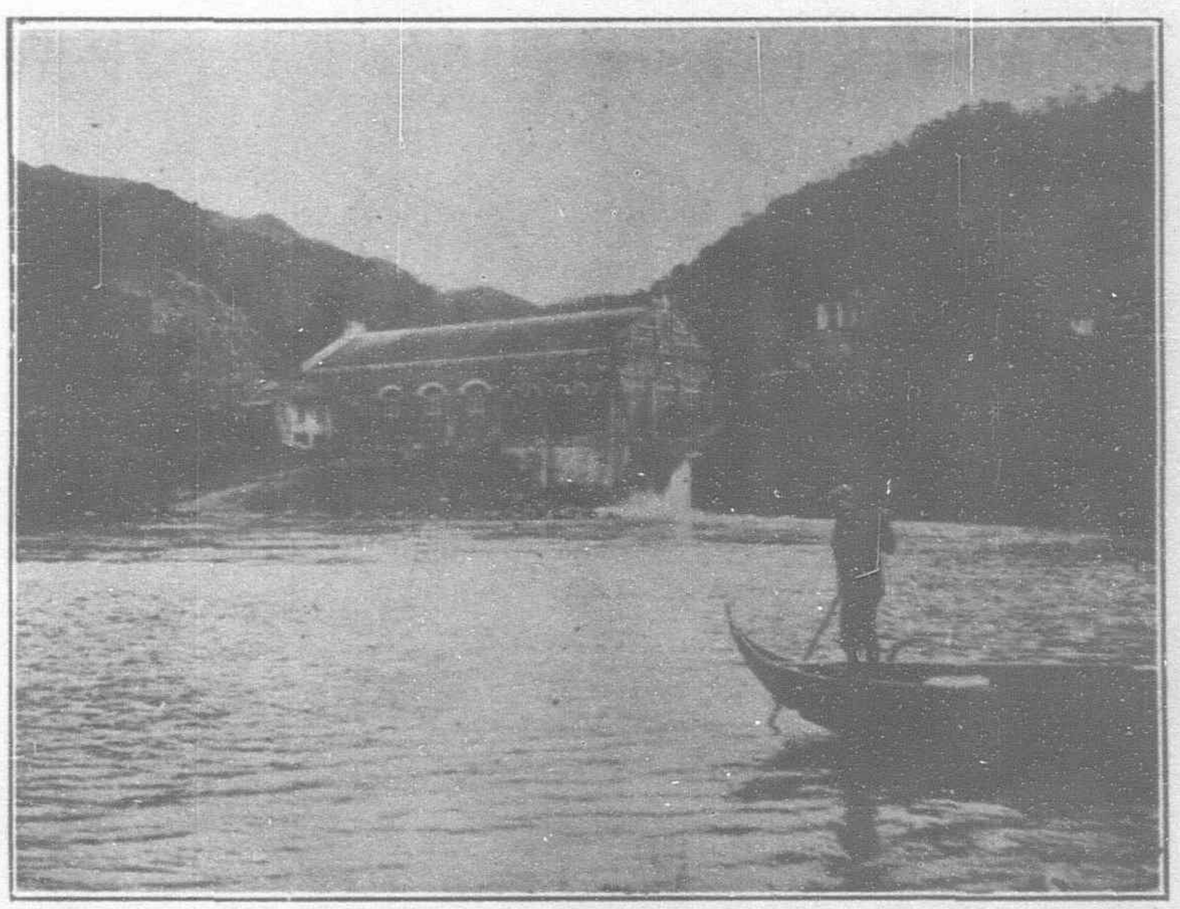
Taiwan Denryoku K.K.

This company was established by a government's decree in April, 1919, with a total capital of Y.30,000.00, half private and half official. After its formal establishment in July of the same year, all the government electric enterprises were transferred to its control on August 1, 1919. The company was organized to carry out a program involving the construction of a great power plant utilizing the waters of Jitsugetsutan lake located in the middle of the central mountain chain, to generate a total of 140,000 h.p., and supply power to all parts of the island at a very low rate.

The plans for this power plant include: (1) An immense dam to raise the surface of the lake waters some 75 feet; (2) in order to maintain a steady supply of water the Dakusui-kei river is to be directed into the lake at the rate of 954 cubic feet a minute; (3) the present volume of the lake, whose area is 593 *ko* (*Ko* equals 2,397 acres), is estimated at 660,000,000 cubic feet; this is to be increased an area of 828 *ko* or 5,747,000,000 cubic feet; (4) with this water supply, it is believed possible to generate 140,000 h.p. at the outset while a second power plant is planned to generate 55,000 h.p., in case of emergency.

Marked progress has been made, and the work is expected to be completed by the end of 1924. The work was started on the top

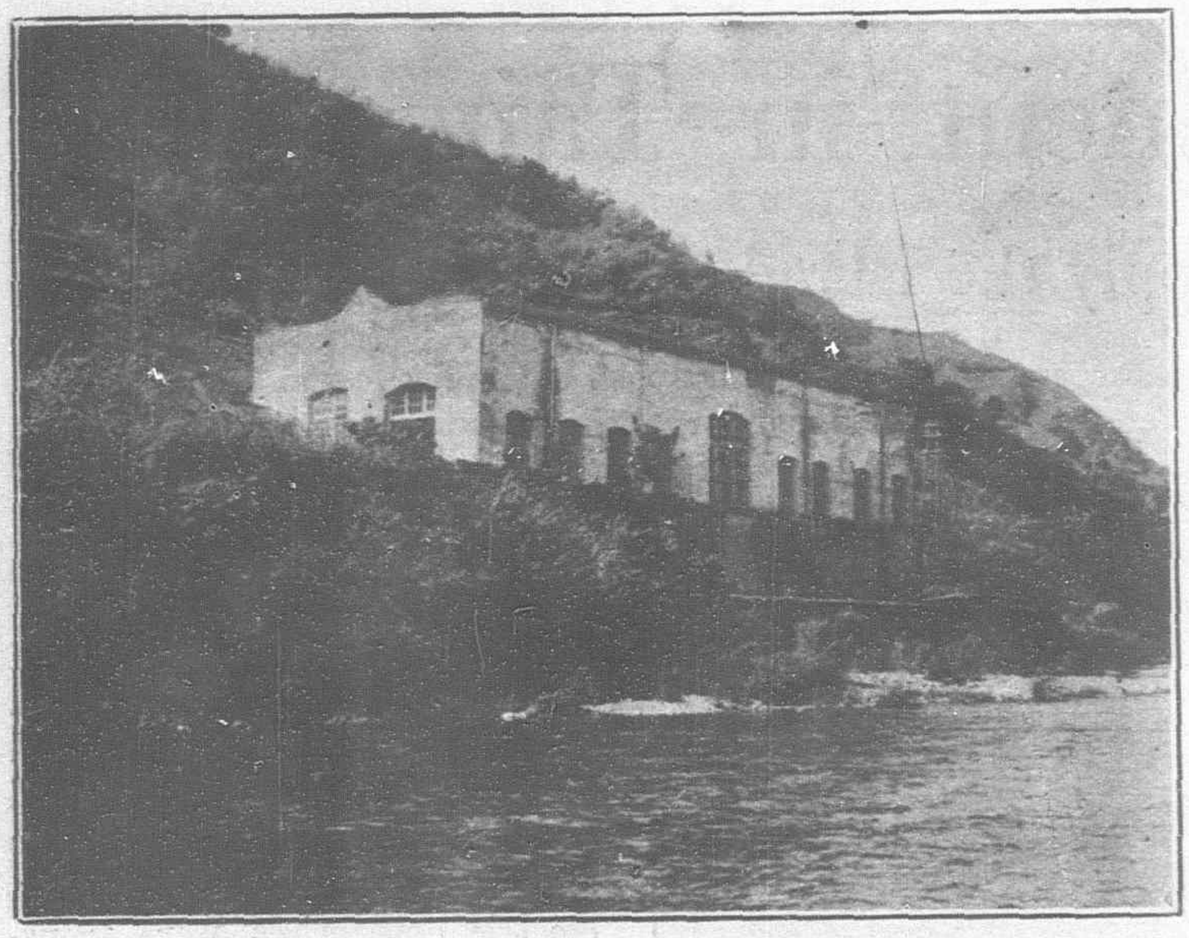


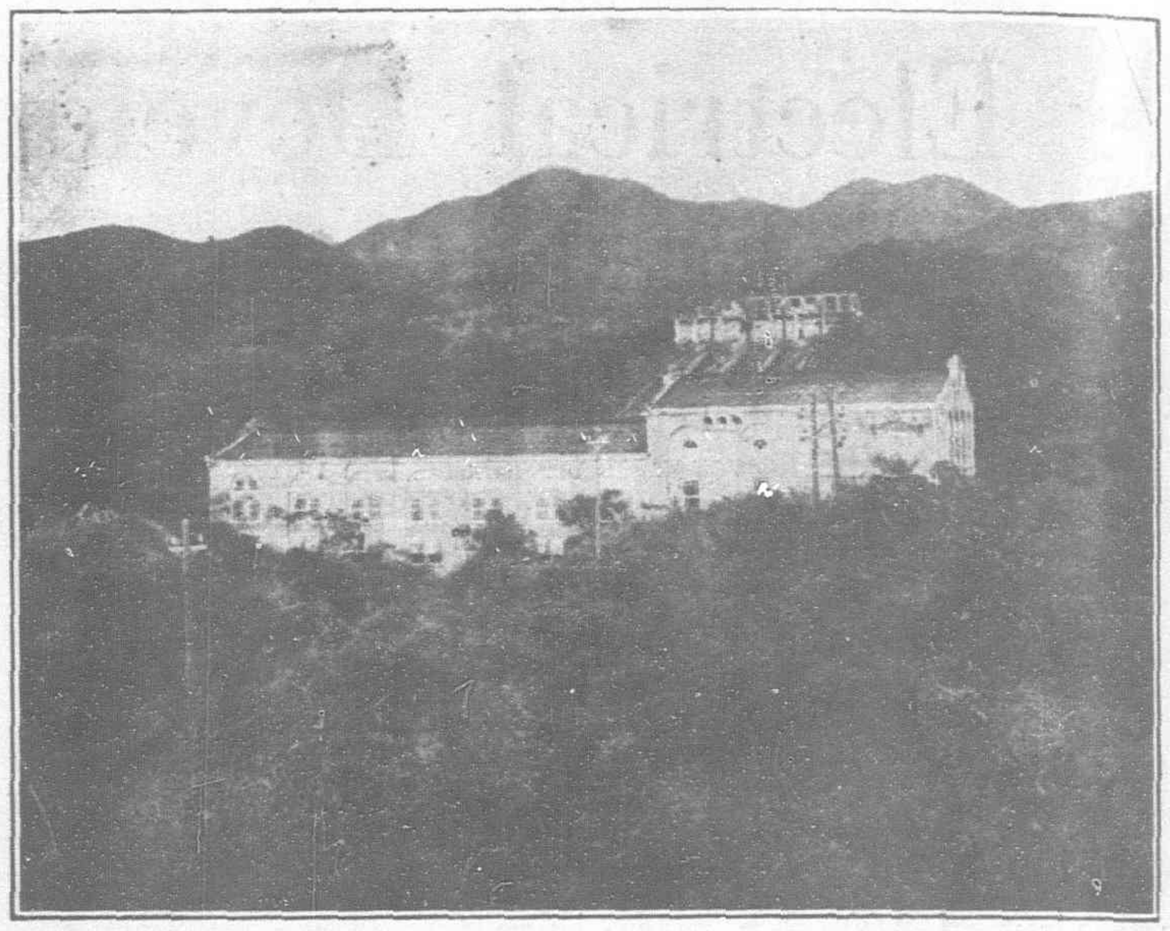


POWER HOUSES OF THE TAIWAN ELECTRIC POWER COMPANY, LTD.

Taihoku Steam Power Plant

Shosoko Hydro-Electric Plant, No. 2



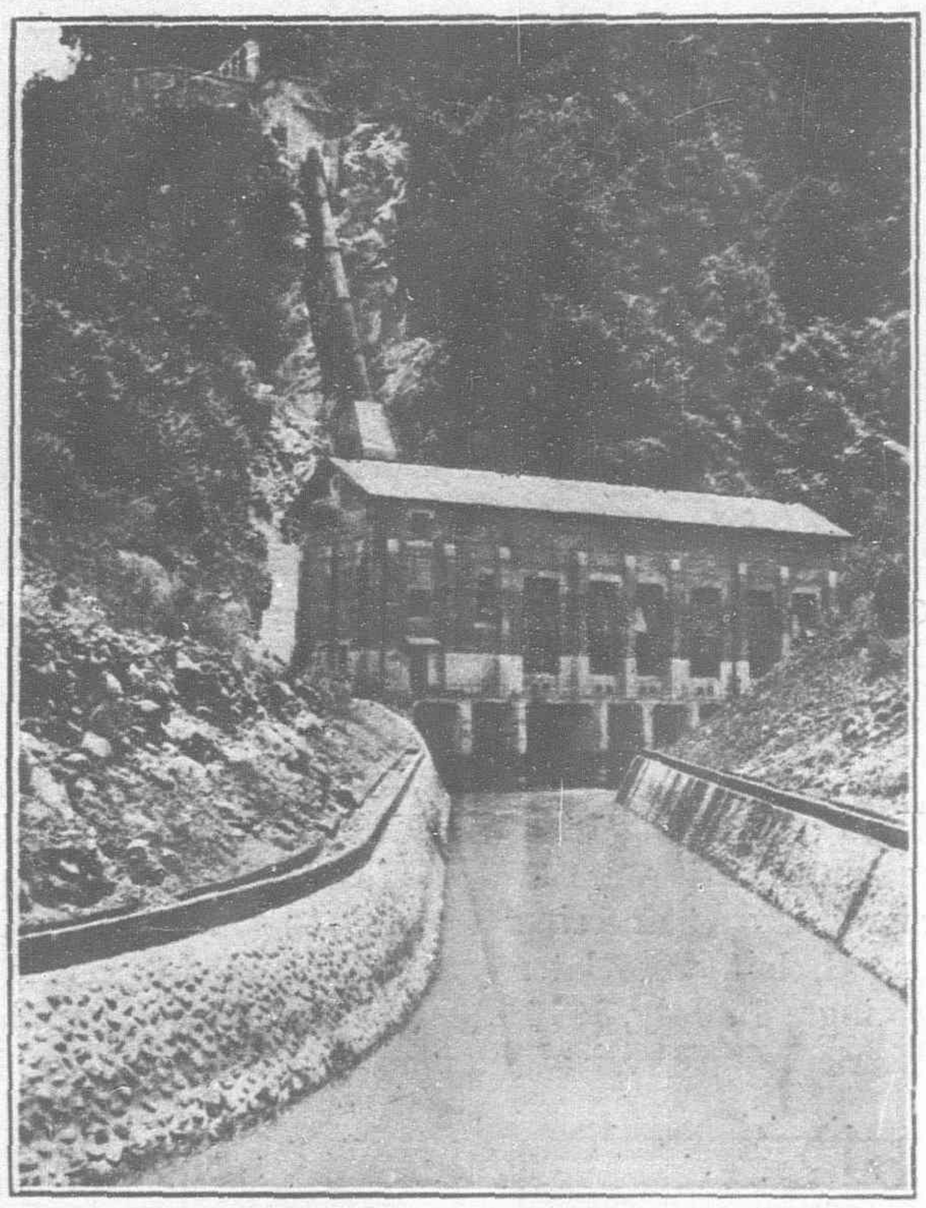


POWER HOUSES OF THE TAIWAN ELECTRIC POWER COMPANY

Kameyama Hydro-Electric Power House **Chi Kushimon Hydro-Electric Power House**

ware of high prices after the great war, on an original estimate for the Jitsugetsutan power plant of Y.18,000,000 raised from capital subscribed by private interests, and by issuing debentures to a total of Y.30,000,000, making the total investment of the company about Y.48,000,000. (The value of the government enterprises taken over was capitalized at Y.12,000,000). But when actual construction was commenced, the excessive costs of equipment, materials, and the high salaries, wages, etc., which had to be met, raised the actual costs from 20 to 100 per cent. above the original estimates. Accordingly the authorities in charge of the construction work stopped work early in 1922 regardless of criticism, and confined their efforts to keeping the partially completed works in good condition.

This step caused quite a flutter in the financial world and many persons believed that the Taiwan enterprise would have to be abandoned. But the company's decisive action at once lowered wages, and remarkable to relate, it was found easier to issue new debentures, and to call up unpaid capital since the works were closed down, than while they were in full operation. Now that the condition of Japan's finances are improving it is hoped that the construction of this great power plant may soon be carried out.



Hokuzanko Hydro-Electric Power Plant

The demand for light and power, in Taiwan, has steadily increased in the past three years, as the table below shows :—

Power used for		End 1919	End 1920	End 1921	June 1922
Electric lights number	..	169,725	208,263	243,551	261,008
Electric fans ,,	..	5,328	9,704	13,599	17,014
Power supplied :					
in small amounts	..	3,969 h.p.	5,848	6,664	7,353
in large amounts	..	6,057	4,947	4,172	4,459

The supply of power in large amounts, sold to industrial concerns, has registered a steady decline, picking up somewhat in June, 1922. This was caused entirely by the inability of the power companies to supply the demand, and their refusal to sell to large consumers, whose trade was not so profitable as the smaller users. The Asano Cement Co., which had been taking 2,150 h.p. from the Taiwan Denryoku K.K., has been obliged to use boilers for the use of waste heat, thus decreasing the amount it required from the electric company. In addition, the Taiwan Carbide Mill was closed, releasing 1,000 h.p. Excluding these two companies, there has been a rise in the supply of power to large concerns.

The water turbines to be used in the Jitsugetsutan power plant will have a capacity of 140,000 h.p., which is about 57,330 k.w. average at the transformer station, reckoning 65 per cent. for the load. Of this total 13,634 k.w. will be used for meeting increasing demand for lights, 6,102 k.w. for fans, and for power supply, small amounts 8,244 k.w., and for large amounts 24,350 k.w. Of the total, it is expected that 10,000 k.w. will be used by the railways when these are electrified, the remaining 14,350 k.w. to be used for the chemical fertilizer industry, soda ash factories, salt refineries, and spinning, refining, paper mills, etc.

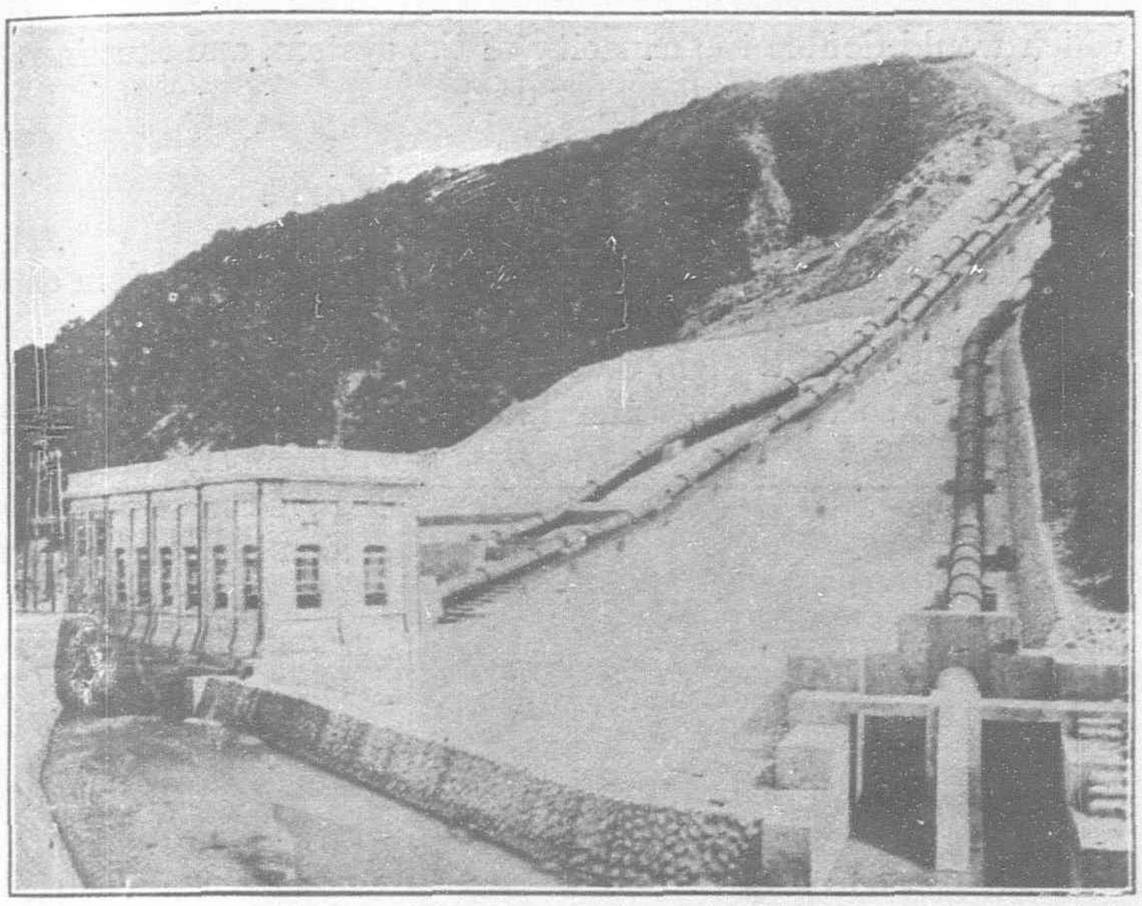
When the government railways, at present about 300 miles in length are electrified, a direct current of 1,500 volts will be used, and a total current of 10,000 k.w. will be needed, if not as much as 15,000 k.w. By the time the power plant is completed it is expected that the railways will be transporting three times their present, freights, and this will require a total of 20,000 k.w. If this estimate is correct within two or three years after the completion of the Jitsugetsutan power plant, there will be a scarcity of power in Taiwan. Judging from experience in Japan proper, there is almost certain to be a lack of power in the not distant future.

The electric enterprises taken over from the government by the Taiwan Denryoku K.K., earned profits of Y.1,000,000 annually when under official direction. After the transfer to the company, about Y.5,000,000 was invested in general improvements. The company is now making an average of Y.3,000,000 profits annually, with which it has been able to pay 7 per cent. dividends, as well as meeting the interest on its outstanding debentures, come Y.560,000 a year. There is no doubt but that the completion of this company's

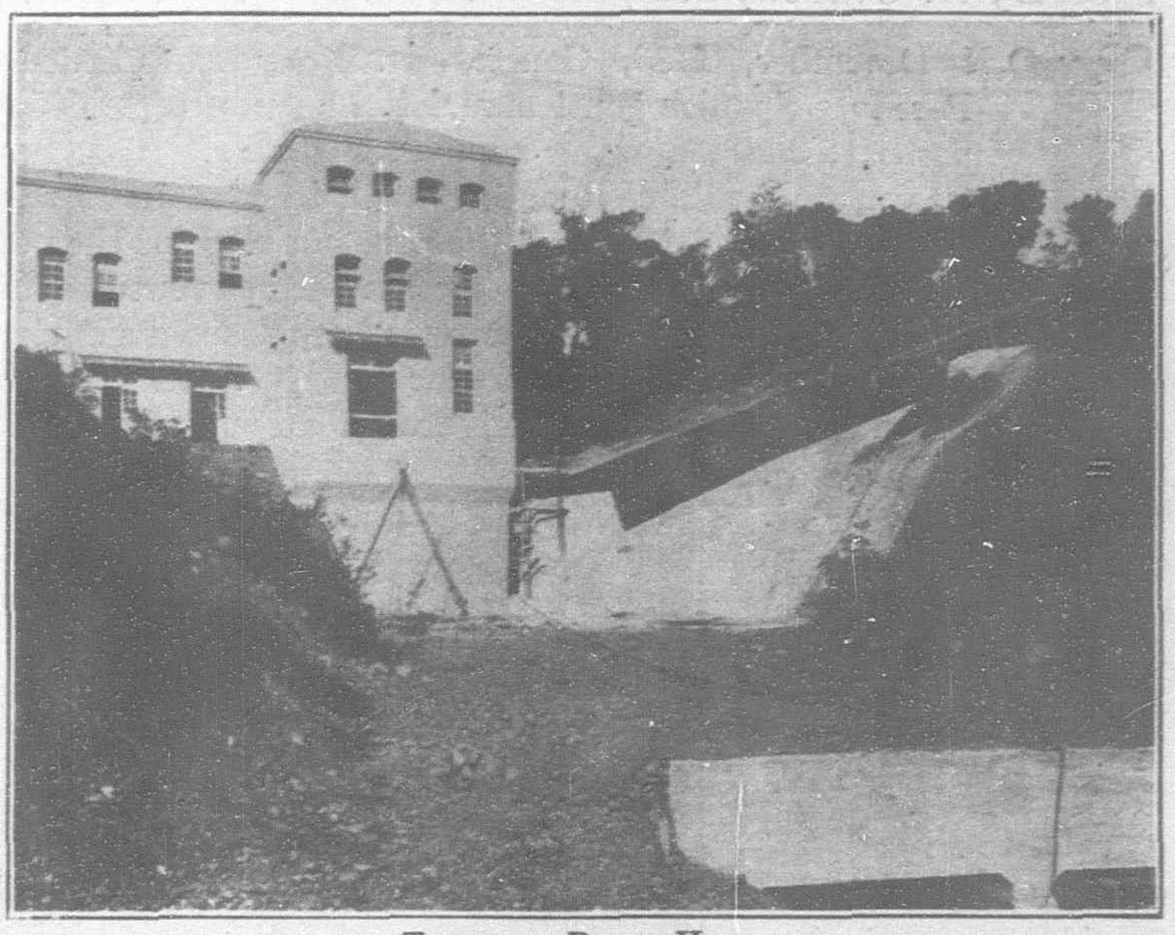
plans will have a most beneficial effect on the industrial future of the island and every effort is being made to find the funds needed for this purpose.

The board of directors of the company consists of: President T. Takagi; Vice-President: G. Sumi; Directors: D. Ogoshi, H. Nagata and G. Takata; Auditors: Kihachiro Okura and Teijiro Yamamoto.

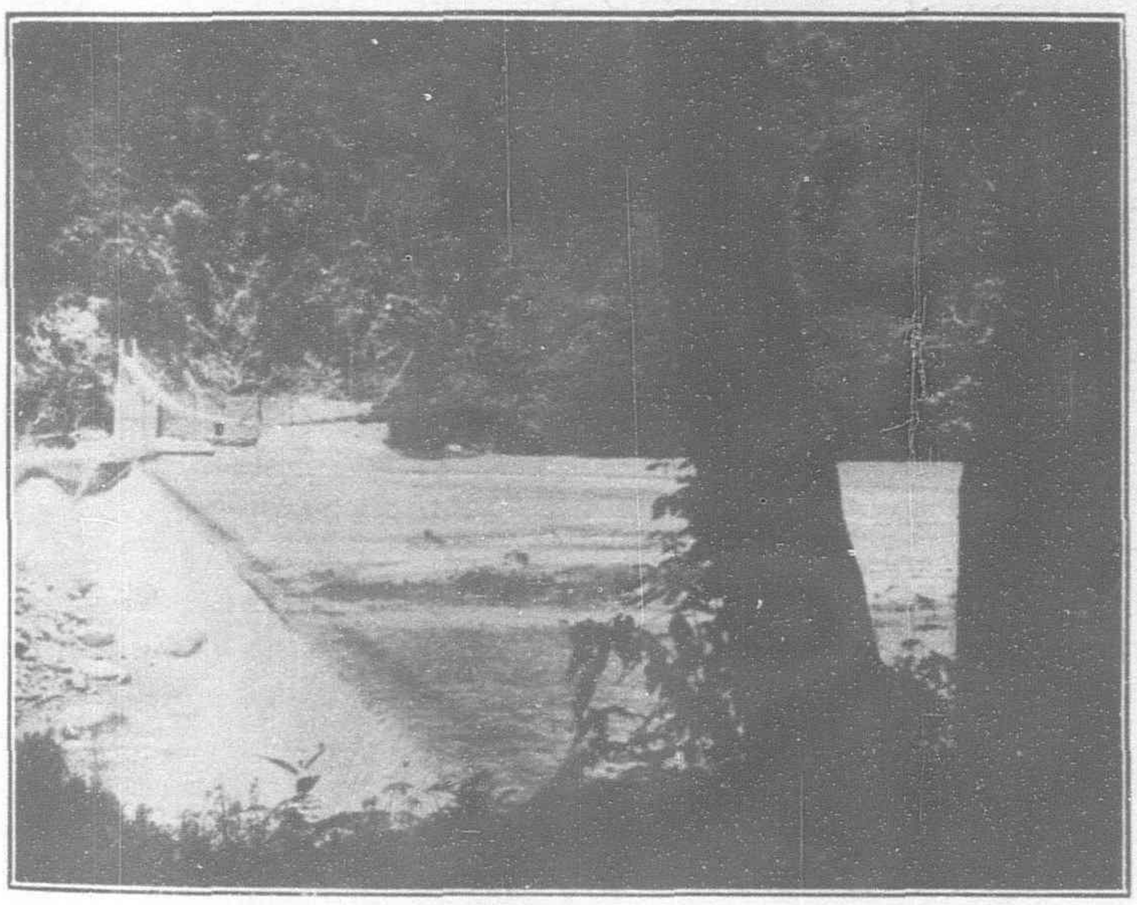
(*Continued on page 320*)



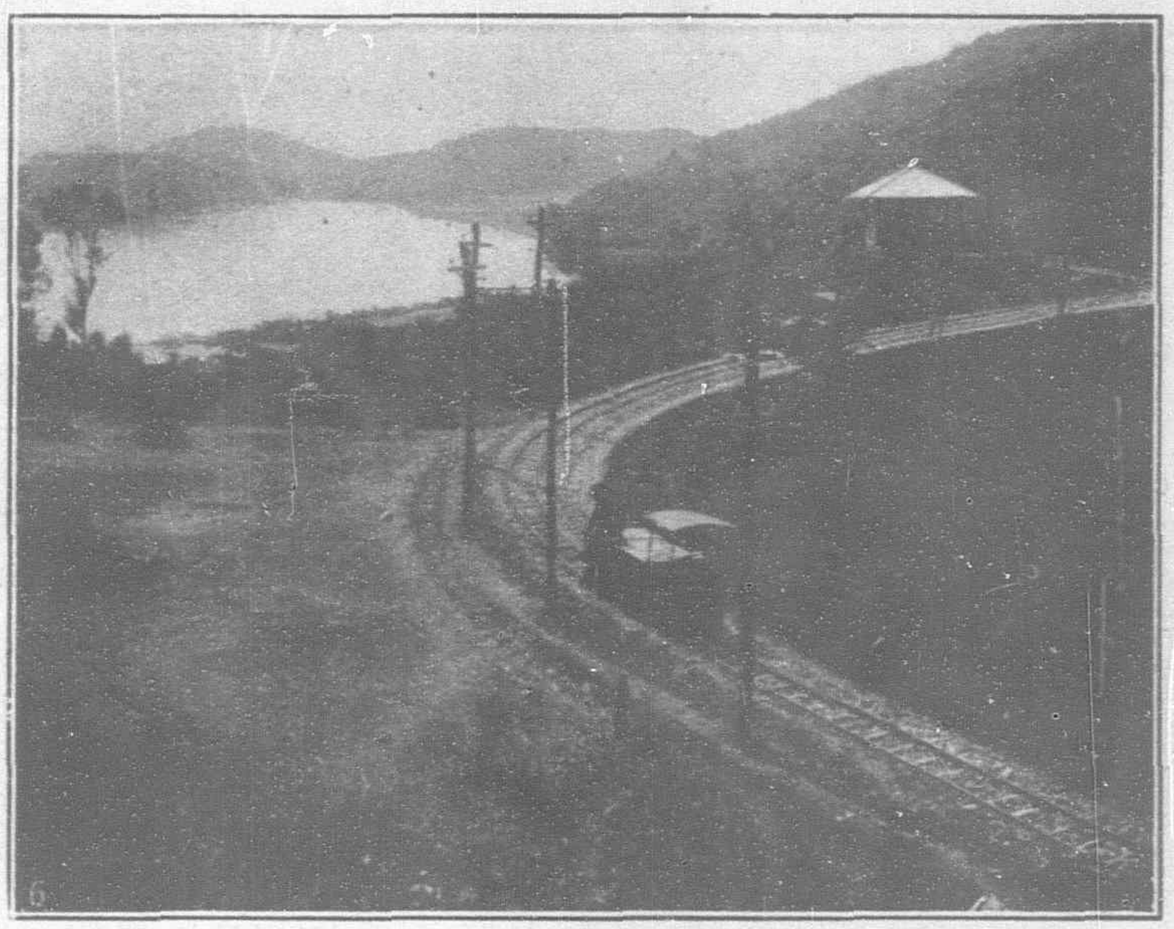
Korisho Hydro-Electric Power Plant



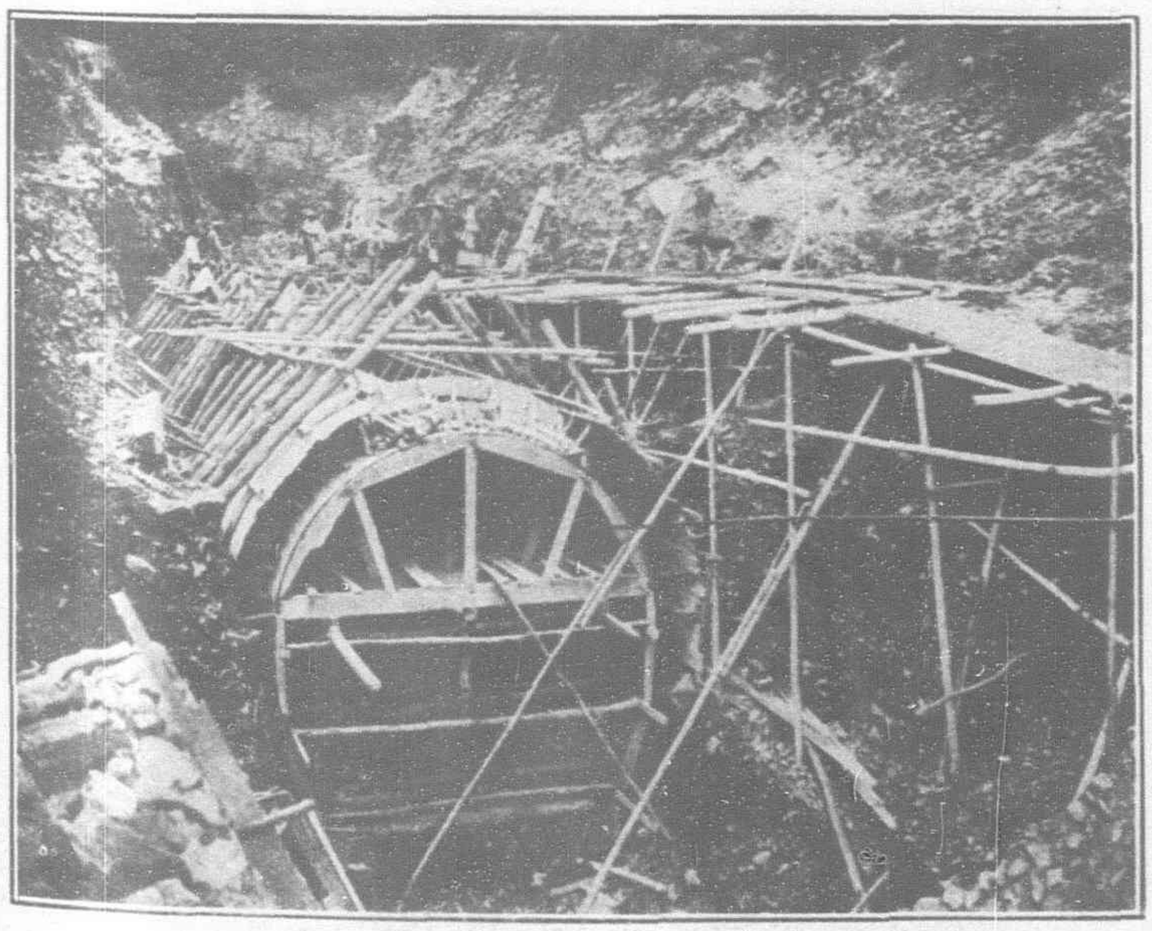
Toryuwan Power House

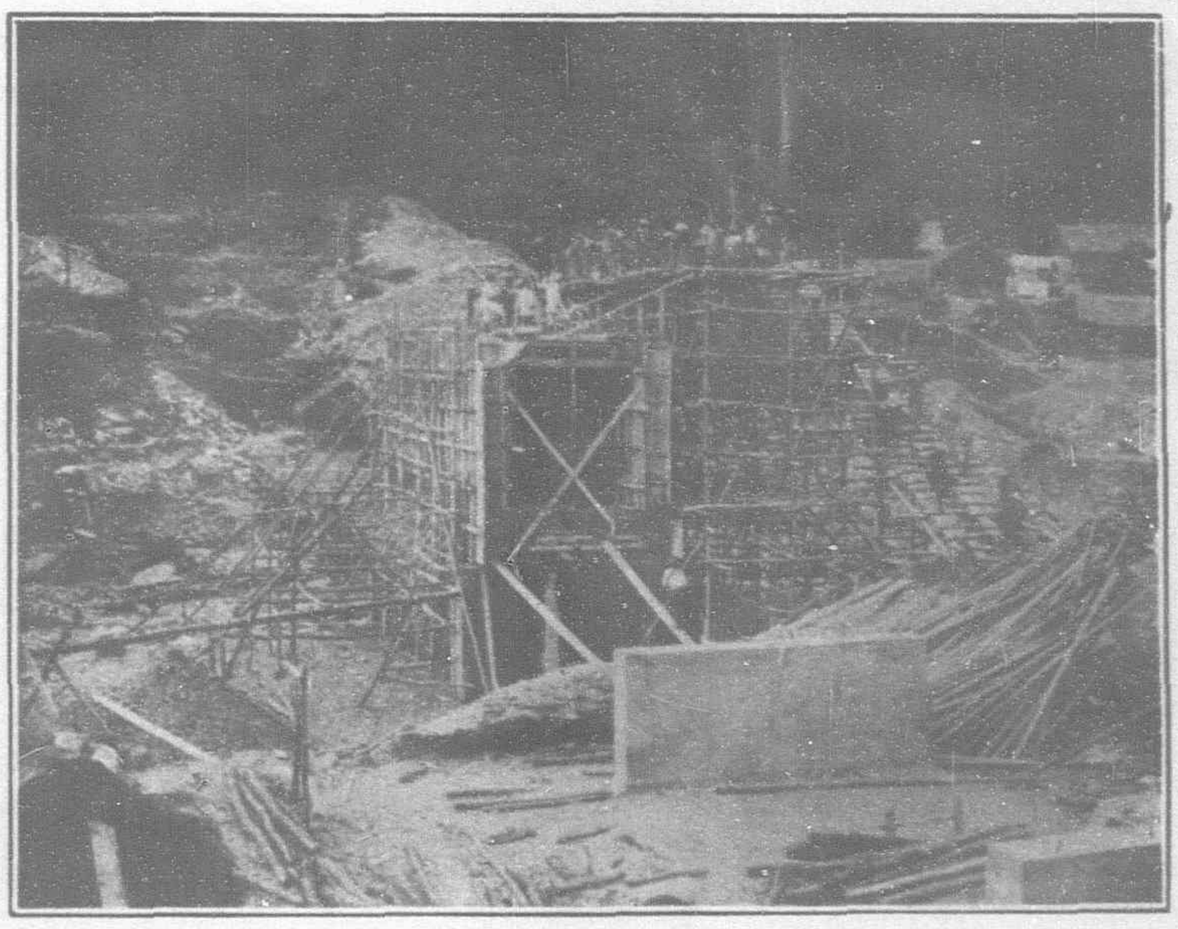


Dam of the Hokuzanko Power Plant



Jitsugetsutan Electric Railway



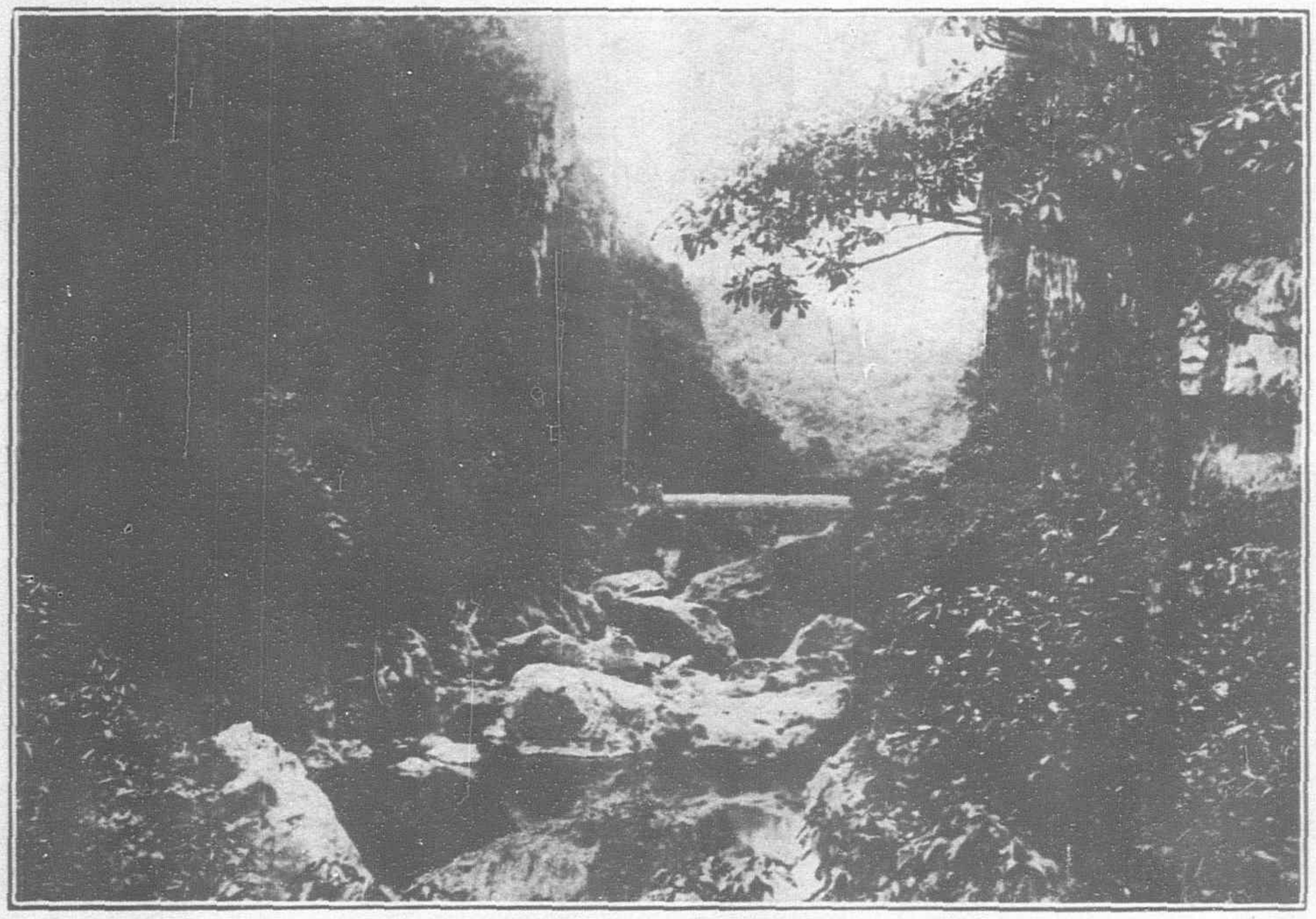


Hydro-Electric Construction Work in Taiwan

Manila Water Supply

By A. Gideon, C.E., M.Am. Soc. of C.E., M.Am. Waterworks Ass'n., etc., Manager and Chief Engineer

IN December, 1733, General D. Francisco Carriedoy Peredo, a Spanish gentleman, left a bequest of 10,000.00 pesos to build a water supply for Manila. This fund was made available upon his death in 1743 but as the fund was insufficient, and the time not ripe for the construction of a water supply it was invested in various ventures, until the capital and the accumulated interests were deemed sufficient to construct a water supply adequate for the city. In 1867 the capital after undergoing various vicissitudes amounted to 177,-853.44 Mexican pesos. In this same year alternate projects were prepared by Señor Don Genaro Palacios to bring water to Manila, first, by a gravity system from Montalban at an estimated cost of 12,250,000 pesetas or some 2,500,-000 Spanish pesos, and second from Santolan by means of pumps at an estimated cost of 745,509 Spanish pesos. Finally, in January 1878, arrangements were made to carry out the second project, and Señor D. Genaro Palacios was appointed chief engineer.

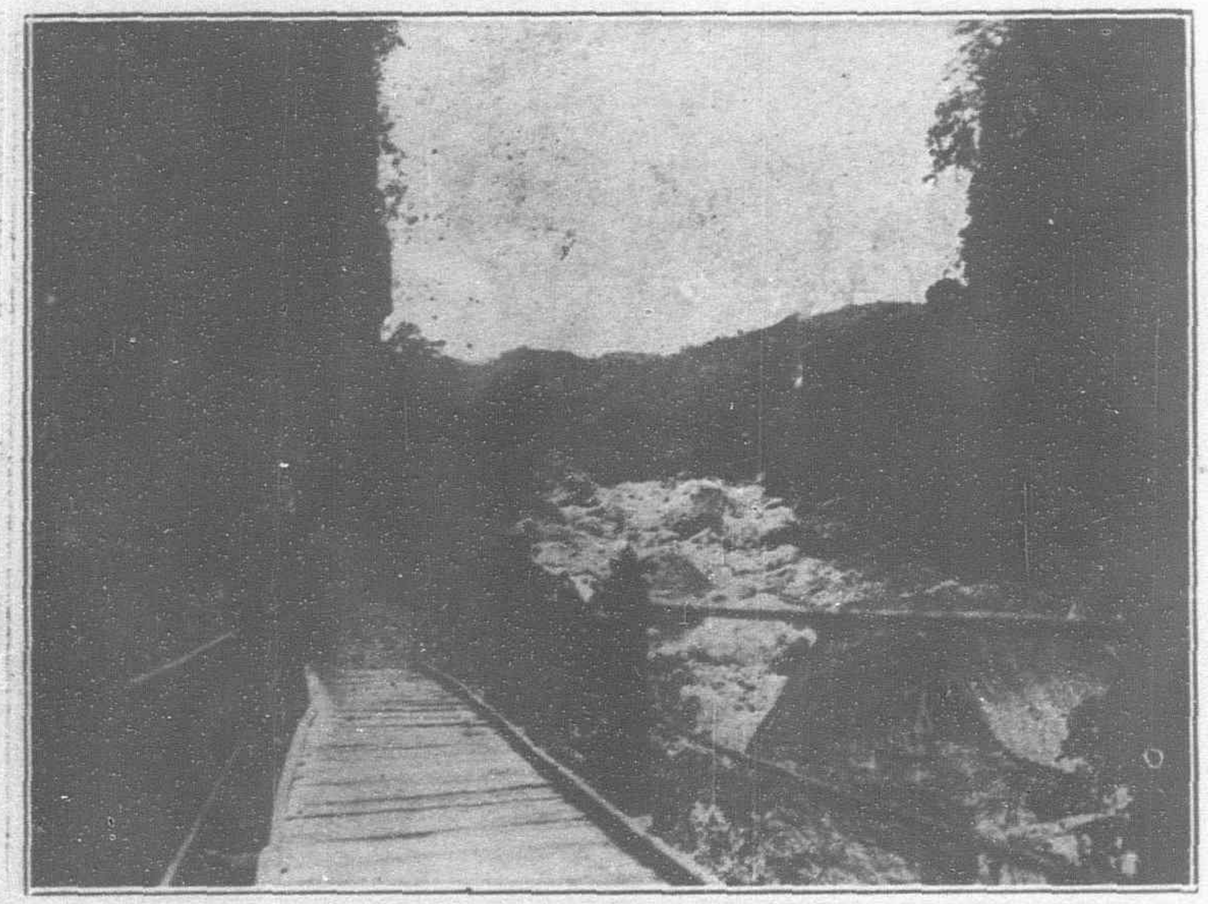


Montalban Dam with 9 feet Flash Boards up

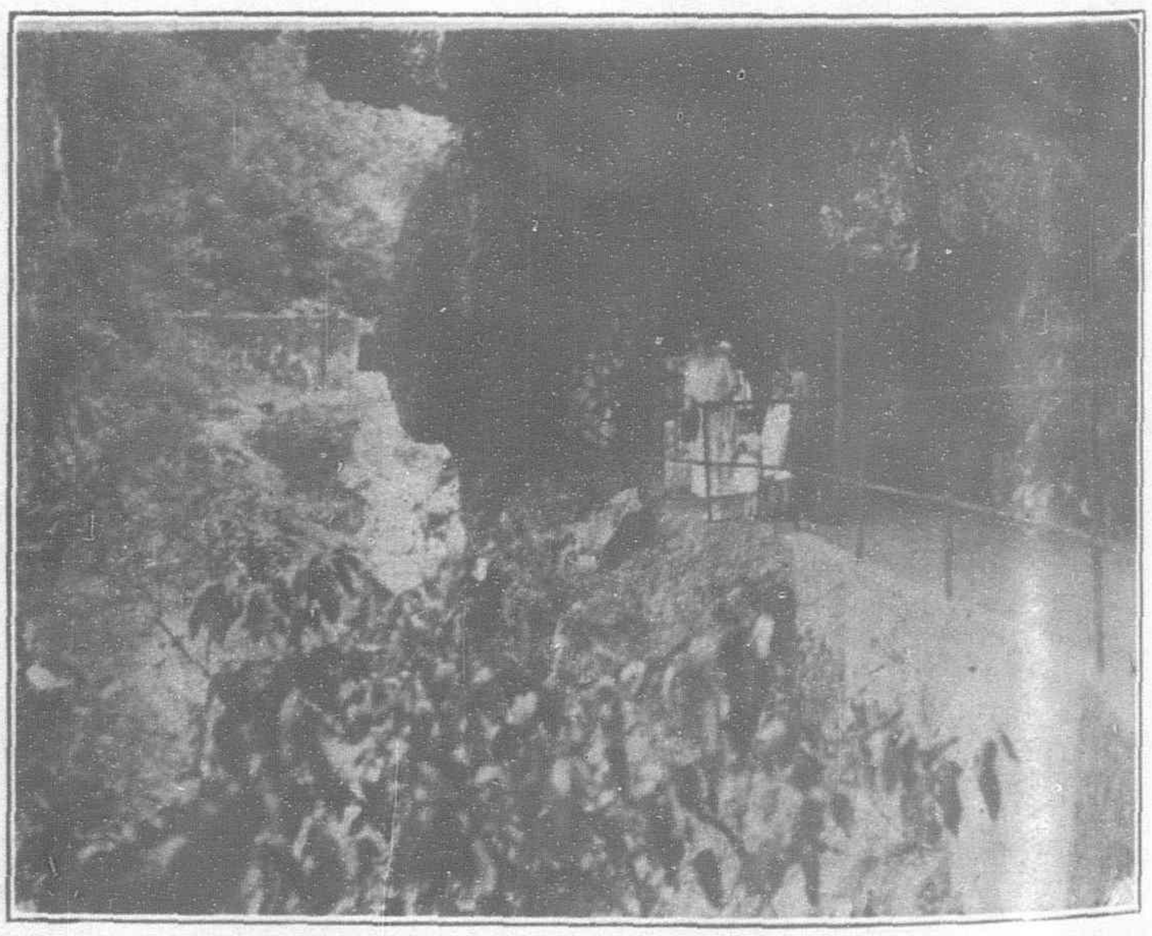
The waterworks were named the Carriedo canal, and the opening was inaugurated in August 1882, though the installation of the pumps was not quite finished then. The water at first used, to the extent of 160,000 gallons per day was the infiltration water that came through the sides of the tunnel. Later on when two of the pumps were in operation, the daily capacity of the water supply amounted to about 2,320,000 gallons per day. Additional space was reserved in the pumping station for two additional pumps which would double the capacity of the system, and thus increase it to about 4,600,000 gallons per day.

Description of the Works

The work consisted of a low diversion masonry dam on the Mariquina River, near the village of Santolan, an infiltration gallery 1,525-ft. long, 5.6-ft. high, 3.94-ft. wide. This gallery was laid of loose stones so that the water filtered through it to the intake chamber, and which gave the wrong impression in the city that the water was filtered. From the intake chamber four intake pipes lead to the four pumps, only two of which were then installed, the second pair of pumps were ordered later and were not installed until after the American occupation, or in 1900. The pumps and boilers were of Scotch make and are still used occasionally during the very dry seasons. The pumps lifted the water through two 20-inch force mains to a small tunnel 10,800-ft. long terminating at the deposito or reservoir. The dimension of the tunnel are 5.6-ft. high and 3.94-ft. wide, and the tunnel is divided lengthwise into two parts, by a 26-inch iron cast pipe inverted syphon, 1,312-ft. long crossing a very deep ravine and river. The syphon is carried across the river on a two arched masonry bridge of 24.6-ft. span, the syphon has a blow off at the lowest place to discharge the sediment that may accumulate in the bottom of the syphon.



Down Stream View Near the Montalban Dam



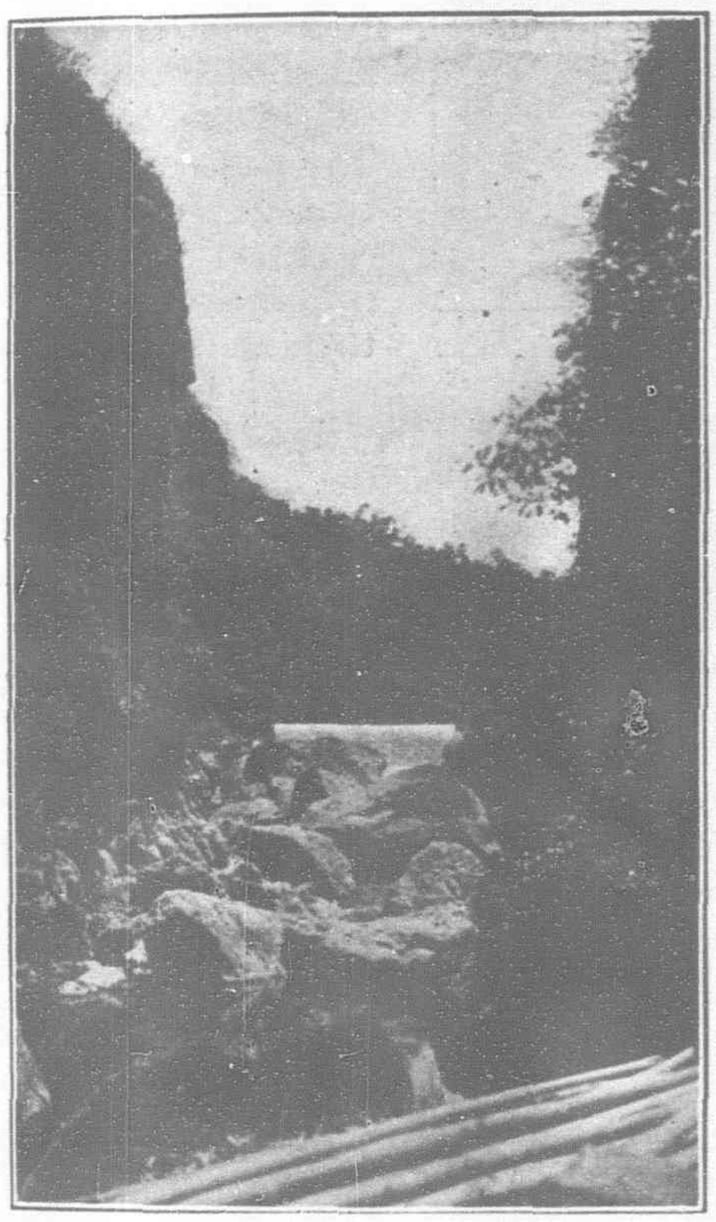
Gate to Montalban Dam and Head Works

The deposito or reservoir has a capacity of 14,784,000 gallons and was increased to 18,000,000 in 1920, by raising the overflow sill. The deposito is divided into two approximately equal parts, consisting of a series of underground galleries with groined arches excavated in tunnel, and is ventilated by 207 openings through the roof, over which shelter hoods were built. The dimensions of the galleries are 19.7-ft. high and 9.85-ft. wide, and they are paved with red and white tile. The elevation of the water was 62.3-ft. above the streets in Manila. The cost of the deposito is given as 110,000 pesos. From the deposito a 26-inch cast iron pipe led to the city, where it was distributed mostly through 4-inch cast iron pipe to such streets as were deemed important enough to have a water main. There were but few houses which had water installations and the water was obtained from public hydrants or small fountains installed for that purpose. The water was carried in pails to the houses, mostly by water-carriers who charged for their labor in accordance with the distances from the hydrants. There were very few water closets and few industrial plants using water and consequently, the 2,300,000 gallons daily supplied, did fairly well for the estimated population of 230,000 prior to 1898, allowing them 10 gallons per capita per day.

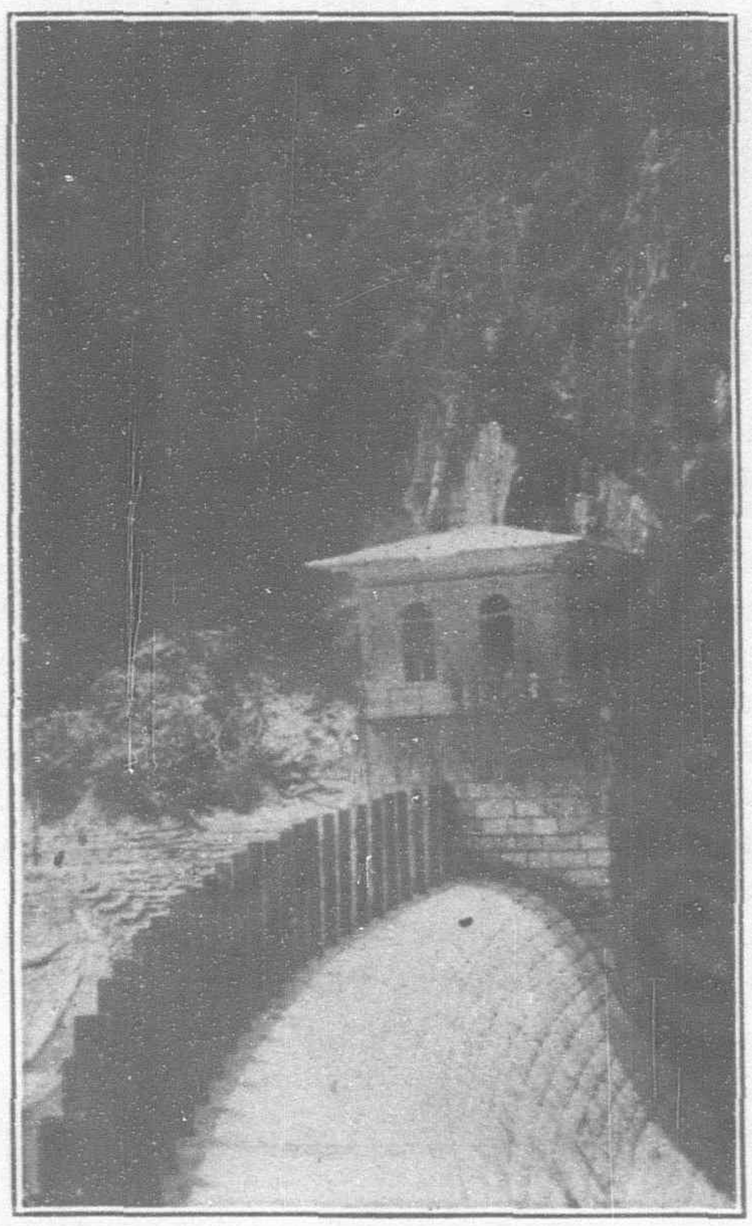
Upon occupation of the islands by the United States, all substantial houses were compelled to install sanitary fixtures and it was at once apparent that even with the installation of the two additional pumps which would increase the daily supply to 4,500,000 gallons, the water supply was entirely inadequate. Measures were taken in 1902, to provide a supply of 20,500,000 gallons per day or about 70 gallons per capita for a population of 300,000, estimated for 1922. A bond issue of $4,000,000.00 United States currency was authorized and the 4 per cent. bonds, sold in the United States at an average of $108, or 8 per cent. premium over par value. Construction was started in 1905, and the work was completed in part in 1909.

The new work on the Mariquina river at Montalban consisted of an arched masonry dam of the O. G. gravity type 191-ft. long on the crest, 36-ft. high above the old river bed, and some 20-ft. below the river bed. The dam is built of concrete, faced front and back with ashlar masonry, which avoided the need of forms for the concrete. The ingredients with the exception of cement were found within half a mile from the dam site. A 4iveted steel pipe 42 inches in diameter carries the water for a distance of 46,660-ft. from the intake at the dam to its junction with a tunnel, and then 31,583-ft. in tunnel to the new distribution reservoir. From the new reservoir, the water is conveyed to the city by a 42-in. steel pipe for a distance of 5,975-ft. to its junction with the deposito or old reservoir above described and from there the water is carried to the city by a new 42-inch cast iron pipe laid parallel to the old Spanish pipe which is used as an auxiliary line. Six inch pipe was adopted as the minimum size for new installation, but some of the 4-inch pipe that existed in the Carriedo system were left in place, and utilized whenever feasible.

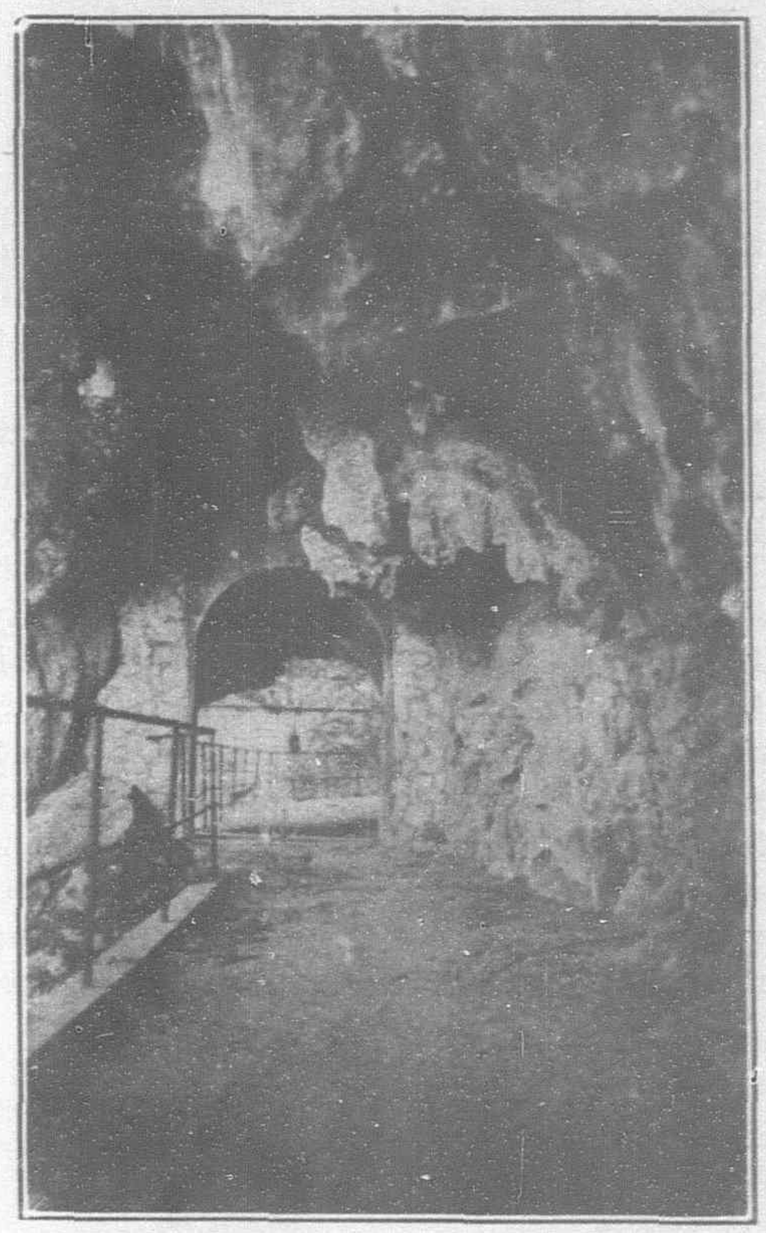
Subsequent to the completion of the system a venturi meter was installed to measure the water coming to the city, and as all services are metered, a fair idea is had as to the distribution of water in the city. However, soon after the completion of the enlarged system it was evident that further extension would be imperative in the near future. The city, however, had arrived to its limits of legal indebtedness and measures were therefore taken to organize the metropolitan water district, which would supply a number of towns in the vicinity of Manila as well as the city itself. The act of the legislature creating the metropolitan water district authorized the sale of bonds to an additional amount of $6,000,000.00 United States currency.



Montalban Gorge and Dam



Montalban Dam and Gate House Showing Steel I Beams in Place to Support the Flash Boards

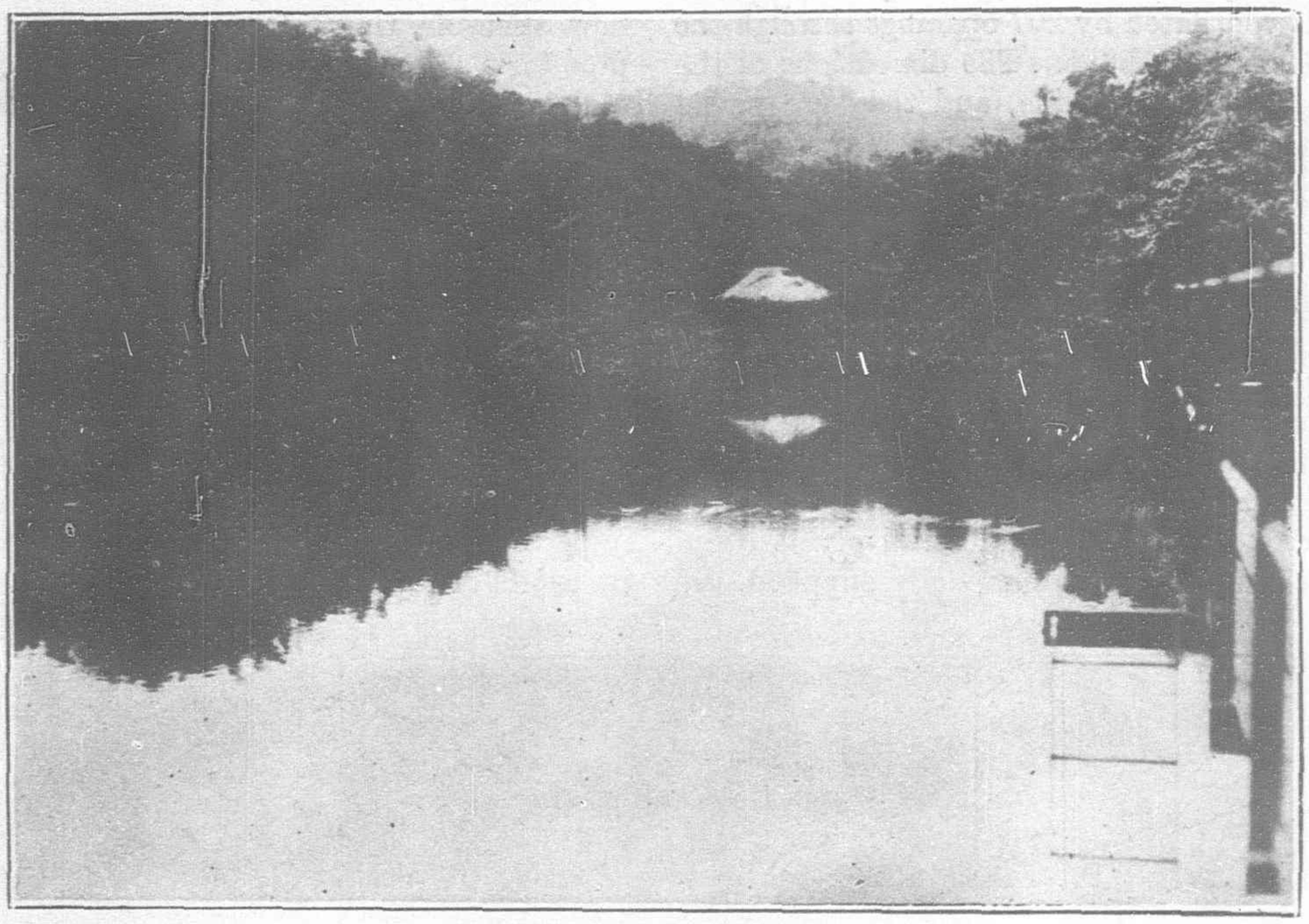


Entrance Gate to Montalban Dam and Head Works

Plans, estimates and specifications are now being prepared, for the immediate diversion from the Angat river of 50,000,000 gallons per day and a total future diversion of 80,000,000 gallons per day, whenever the needs of the district should warrant same. The main features of the project such as the diversion dam on the Angat river, the tunnels from the dam to the present pipe line, are all proportioned for an 80,000,000 gallon per day supply, as the cost of the work will be practically the same for either quantity. The filtration beds, pipe lines, storage reservoirs, etc., are, however, designed for a 50,000,000 gallon per day supply, and can be readily extended when conditions will warrant same.

The population of the city is now estimated at 300,000, and there are about 100,000, people in the metropolitan water district outside of the city. The estimated population of the city of Manila for 1950 is 500,000 and for the suburbs 150,000, so that the 50,000,000

gallons per day provided for are estimated to be sufficient till 1950. Should the city develop more rapidly than estimated, they can draw upon the remaining 30,000,000 gallons per day, at a small additional outlay. It was not deemed advisable, at the present time, to provide for more than 25 years hence, on borrowed capital, as the accumulated interest and sinking fund contributions, on the additional expenditures capitalized at 4 per cent. for 25 years will be more than sufficient to build the needed extension at that time.



Reservoir at Montalban Above Dam

Per Capita Consumption

The per capita consumption in 1898 was 10 gallons per capita per day, in 1908 or just prior to the completion of the Montalban system was 19 gallons, while the present consumption is 73 gallons per capita, and the indications are that in twenty years hence, the consumption is likely to reach 100 gallons per capita. The per capita consumption in Manila is the highest of any place in the Orient, and also greater than many of the larger cities in Europe, but is considerably less than for similar or larger cities in the United States. The reasons for the high per capita consumption, are, the location of the city in a tropical belt, where bathing is more freely indulged in; the universal installation of water flushed toilets; comparatively heavy street sprinkling and flushing; the installation of a sanitary sewerage system, and last but not least the very low price of water to the consumers, which is 5 centavos per metric ton, or about 8 cents United States currency per 100 gallons.

All services are metered, are read monthly, and bills rendered quarterly. Whenever any considerable increase in consumption is noted, a notice is sent to the owner of the property, calling his attention to the excessive consumption and suggesting that the fixtures and interior pipe lines be examined and repaired if necessary. We now have about 14,500 services, and they are at present increasing at the rate of about 1,500 new services per annum.

All the installations up to the meter are done by the metropolitan water district, and the interior installations by licensed private plumbers. The meters are maintained in working condition by the metropolitan water district, and on the average 25 per cent. of the meters are repaired every year. Our shops are equipped with modern machinery for all work that the district has to do, and include, machine shop, blacksmith shop, carpentry shop, foundry, tinsmithing, painting shop, etc. This arrangement enables the district to do its work promptly and economically.

The metropolitan water district is a governmental institution, but is governed by a board of directors, who meet once a month, ond oftener if necessary, and have jurisdiction of both the water supply and the sanitary sewerage systems.

All the employees excepting laborers are under the civil service rules of the government of the Philippine Islands, the manager and assistant manager are appointed by his excellency, the governor-general, with the approval of the senate.

Singapore Water Supply

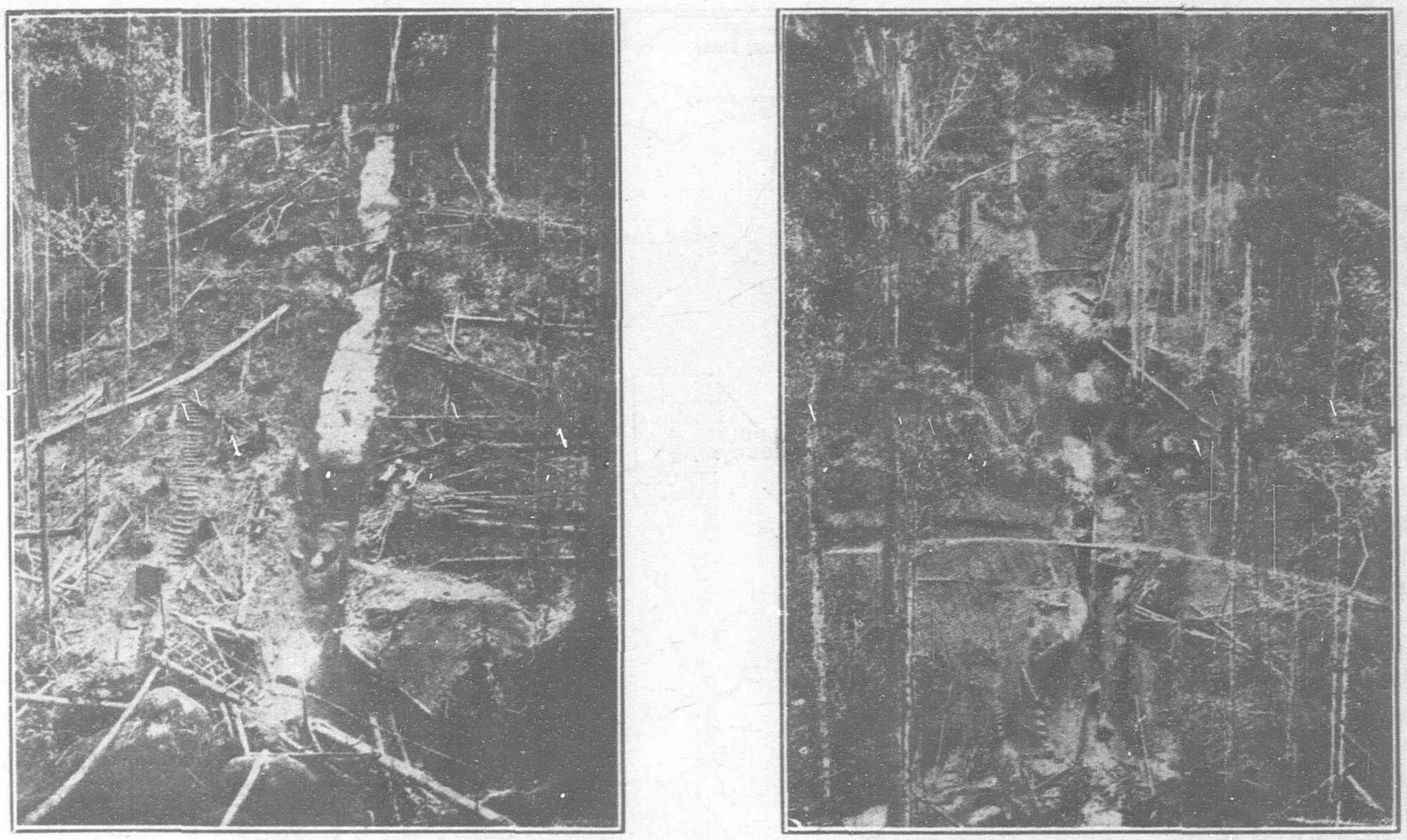
From "The Engineer"

IT is general knowledge that Singapore is an island which was ceded to Great Britain by the Sultan of Johore in 1824. The water supply of Singapore town, which lies to the south of the island, has hitherto been, and is at present obtained, from impounding reservoirs built within the island itself. The daily quantity of water available is 11 million gallons, and as the population supplied is 334,000 and the average consumption is 32 gallons per head, it will be realized that there is immediate necessity for seeking an additional source of supply. Indeed, the need has been evident to the municipality for some years past, but one of the difficulties in the way of meeting it has been that the local sources on the island itself are very nearly exhausted; at any rate, they are incapable of adding sufficiently to the quantity of water at present available to meet the wants of the municipality for any length of time ahead.

Several schemes for obtaining additional supplies have been considered, among which may be mentioned those for obtaining water from :—

(*a*) A source known as the Pulai rivers.
(*b*) From a source known as the Pelepah.
(*c*) From the Lenggin, a tributary of the Johore River.
(*d*) From the Skudai River.
(*e*) By development of the Seletar area on the island.
(*f*) By erecting dams across the estuaries of certain tidal rivers.

The Pulai scheme was prepared by the municipal engineers, and it was eventually approved by the commissioners. Before finally adopting it, however, it was decided, having regard to the facts that it would be costly to carry out, and that a government



Excavations on Either Side of the Valley for Foundations of Dam

loan would be required for the purpose, to take expert advice on the subject. The crown agents for the colonies accordingly approached the firm of SirAlexander Binnie, Son and Deacon, of Westminster, and it was arranged that Mr. Martin Deacon should go out to Singapore and make a thorough investigation on the spot. He has now returned and, through the courtesy of his firm, we are enabled to place before our readers the following information.

All the schemes mentioned above were investigated, and of them all the first—the Pulai scheme—was chosen for recommendation for reasons to which we shall refer later. Meanwhile, it may be said that the municipality we also advised to make careful records of the flow of the river Lenggiu, the reason being that in that river there is, in Mr. Deacon's belief, a flow sufficient to meet the whole of the requirements of Singapore for many years to come. It is true that pumping would be necessary, but, on the other hand, no large dam or impounding reservoir would be necessary, the supply being taken direct from the river.

Before passing on to consider the Pulai scheme in detail we may, perhaps, refer briefly to Mr. Deacon's conclusions with regard to the other proposals. As concerns the Pelepah, the position of which may be seen on the accompanying map, it is acknowledged that considerably more water could be obtained from it than from the Pulai rivers, but its adoption would involve the construction of a large dam, and every drop of water would have to be pumped to Singapore—a distance of 56 miles. To pump from the Pelepah source the 6½ million gallons per day—which is the volume that can be obtained by gravity from the Pulai works without any pumping at all—would, Mr. Deacon calculates, amount to no less than between £45,000 and £50,000 per annum. Then, as regards the Skudai River there is the objection that, though without doubt there is sufficient flow to enable a supply adequate to meet the needs of Singapore for many years to come to be obtained by pumping the water is particularly dirty, and very large and expensive settling reservoirs would be required to clarify it before it could be passed on to the filters. Moreover, the nature of the ground is such that the cost of those reservoirs would be extremely heavy, so that on all counts the source cannot be considered as a serious rival of the Pulai scheme. One of the great advantages of the latter is that it can be proceeded with in sections. By laying the pipe line—which will be about 32 miles in length—it will be immediately possible to obtain a supply of 2½ million gallons of water per day without having to build any dam. The construction of a dam across the Pulai River will make available about another three to four million gallons per day. Then it is considered possible that, by erecting

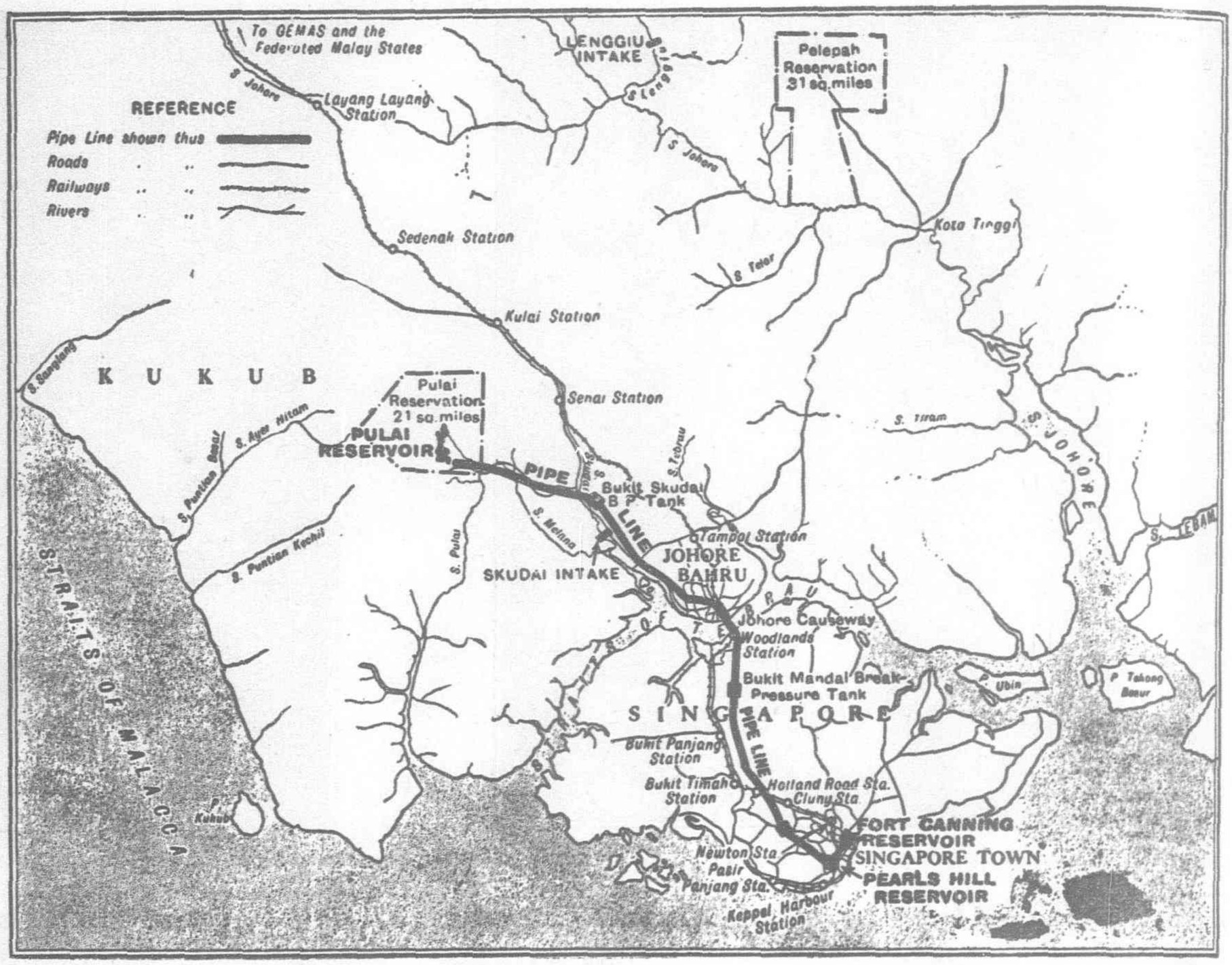
Site of Pulai River Dam

weirs across certain of the streams to the westward of the Pulai River, and by bringing the water thus derived by gravity to a pumping station, so that it might be lifted into a second reservoir formed by the construction of another dam, not far from the first, a further supply, the exact volume of which is not as yet accurately ascertained, but which would not be less than five million gallons, could be secured. This additional volume would, after being pumped into the reservoir, flow by gravity to Singapore. In all, therefore, the Pulai scheme will, it is estimated, possibly yield as much as eleven to twelve million gallons per day, and perhaps more, and it could be proceeded with bit by bit.

Without further information it cannot be said whether the valleys to the west of the Pulai River are suitable for the formation of reservoirs by means of dams. If they are, then a very much larger volume of water could be made available. Up to the present, however, it has been impossible to survey all the valleys sufficiently thoroughly to enable a definite decision to be come to on the matter. The matter of surveying is extraordinarily difficult and expensive by reason of the facts that the valleys are clothed with thick forests, and that the undergrowth is particularly dense. Survey parties must literally cut their way through every yard traversed. Sometimes the forest growth is so luxuriant that trees on the two banks of a stream interlock above it and are thickly bound together by creepers of enormous strength and thickness of vines and foliage. The result is that the work of surveying is slow and exceedingly laborious, and, furthermore, it is by no means without its dangers, for the bush is full of snakes and other poisonous reptiles and insects, including mosquitoes in vast quantities. Investigations will, however, be carried out in order to determine whether and, if so, which of the valleys can be satisfactorily dammed.

The soil throughout the district is for the most part disintegrated granite interspersed with huge granite boulders, some of them weighing 100 tons and more. In some cases curious depressions caused by erosion occur in the sides of a valley which, unless they too were dammed, would render that valley useless for forming a reservoir. So thick is the forest and undergrowth, however, that it is impossible to say whether such places exist in any particular valley until every yard of the watershed of the valley has been traversed, and, as a matter of fact, it is in many cases extremely difficult to ascertain where the watershed comes. Possibly aerial survey, such as is being used with success for similar purposes in the forest areas of Canada and the United States, would reveal the depressions; but, so far we understand, it has not been resorted to.

As the Pulai scheme had been most favored by the municipal engineers, the ground in the neighborhood of the site proposed for the first dam had been cleared fairly thoroughly. It was, therefore, possible for Mr. Deacon to examine it more closely than was the case with any of the other schemes. The three views on the preceding page are reproduced from photographs taken from three different points. The engraving at the bottom represents a view taken a right angles to the proposed line of the dam, looking up stream. The two upper engravings show the banks of the valley on either side. Excavation work is in progress on the line of the dam, and the white patches in the upper views show some of the huge boulders of granite which have been uncovered. They are, of course, loose, and solid rock has not yet been encountered.



Map Showing Position of the Pulai Reservation and the Route to be Taken by the Pipe Line to Singapore

The water of the Pulai River is of great purity, and is exceedingly soft, but owing to the immense amount of sedimentary matter which is washed from the sides of the hills during heavy rainfalls, and which discolors the water, it will have to be filtered before it can be used for domestic purposes, the filtration being carried out before the water is sent down into the aqueduct. The island of Singapore is separated from the mainland of the state of Johore by straits, which in their narrowest part are only some $\frac{5}{8}$ mile wide. It would have been possible, of course, to bring the water across to the island in pipes laid in the bed of the channel, as has been done in other parts of the world, notably at New York, but fortunately, what is known as the Johore causeway is being constructed so that the pipe line can be run across it, and the necessity for designing special joints for the underwater portion will be avoided.

It may be added that Mr. Deacon recommended the original scheme, as worked out by the engineers of the municipality, after making considerable modifications and alterations. It is estimated that the first additional supply from Pulai could be made available by the year 1929, and that, in the meanwhile, the situation can be eased by obtaining another million gallons per day from Seletar on the island itself.

Siamese Contract for Rails

The contract for rails and accessories for the Siam State Railways, tenders for which were opened on April 16, was awarded to Les Petits Fils François de Wendel through their Bangkok agents, Comptoir Français du Siam. The total amount of the contract is £124,844-1-6, made up as follows: Rails, £109,769.12.5½; fish-plates £ 8,715.0.0; bearing plates £ 6,359.9.0½. The price is c. i. f. delivered at the Railway wharf.

The Design and Construction of Machinery for the Milling and Blending of Tea

IN view of the fact that the preparation of the tea leaf is now a much more refined and scientific process than was the case years ago, the manufacture of machinery for the milling, sifting, and blending of the tea leaf has become an industry of the greatest importance.

Among the firms who specialize in the manufacture of machinery for this purpose, special mention must be made of Messrs. Henry Pooley & Son, Limited, of John Bright Street, Birmingham, who have long been known as manufacturers of the well-known Bartlett tea machinery.

One of the specialities which deserves detailed description is the Bartlett patent automatic tea blender, Type No. 2000. This machine is made in capacities up to 3,000-lb. at one operation, and is shown on illustration No. 1 herein. It is purely automatic in action and operates as follows:

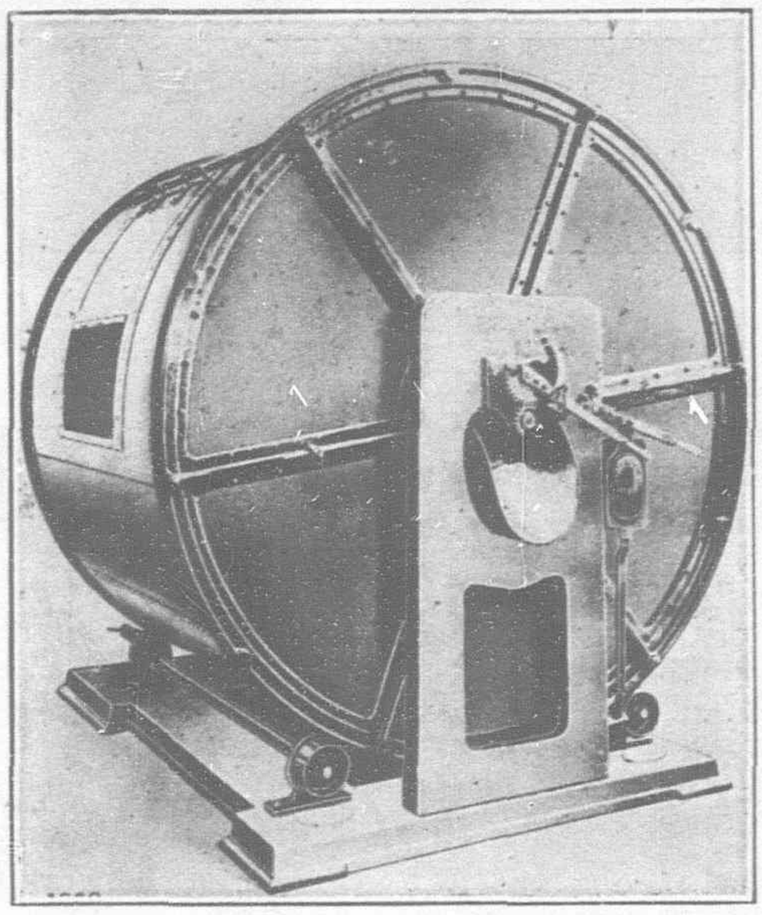


Fig. 1. Bartlett Automatic Tea Blender

The leaf tea to be blended is discharged into the main drum of the blender. The blender is fitted with an attachment described as timing gear. By means of this attachment the number of revolution of the blender, which can be varied at will, is automatically controlled, and at the end of that period the machine automatically stops, the blending operation having been completed.

When it is desired to discharge the contents of the blender, the discharge valve is opened by means of a small hand lever, and this operation automatically sets the blending drum in motion again. The blender continues to revolve as the tea is discharged until the required quantity of tea has been removed when the discharge valve is closed, which operation automatically stops the machine.

This machine can be fitted with an attachment for removing dust during the blending operation. The dust is collected in a special receiver, and it is not necessary to install a long pipe line. The machine is very compact and takes up very little floor space. The blender drum revolves on machined inter-friction rollers. The feed can be varried out either from chests of tea at the side of the machine, or from overhead hoppers. The power required to drive this machine is very small, the largest size only requiring a 4 h.p. motor. The Bartlett tea milling and sifting machine is shown on illustration No. 2.

This is a large machine having eight cutting rollers. The same machine can be supplied in all sizes to meet the amount of tea which has to be handled. The necessity and advantage of tea merchants being able to place before their customers an even and uniform tea is now generally acknowledged, but this can only be obtained by a process which sifts out the small tea and passes only the large leaves into the cutting mill. The Bartlett patent tea mill and sifting machine is designed to meet this requirement.

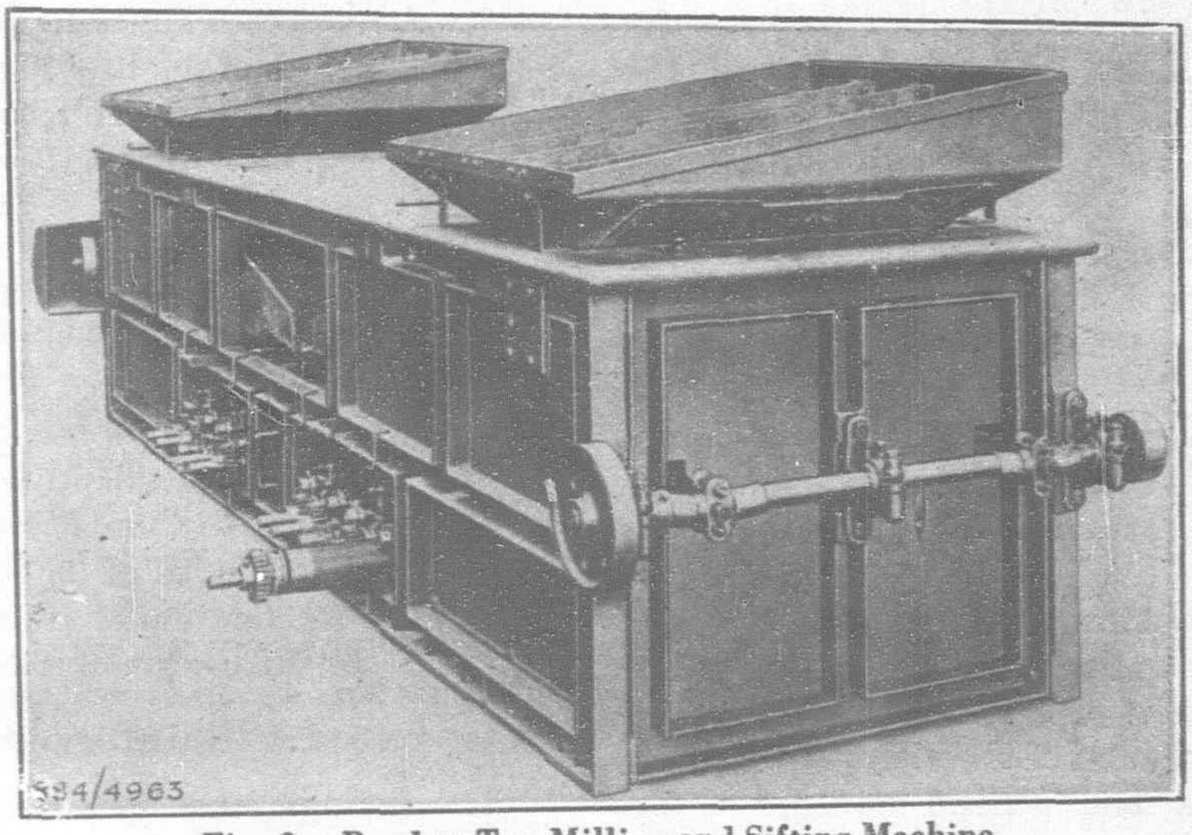


Fig. 2. Bartlett Tea Milling and Sifting Machine

Among improvements which have been introduced in this machine is an attachment which automatically collects all foreign substances such as paper, tea, lead, pieces of wood, or other obstructions and prevents them from being driven into the cutting mill.

The machine can also be fitted, if desired, with an electric magnetic nail extractor which collects all nails which find their way into the tea, and prevents them from getting into the machinery.

The machine is practically noiseless and requires very little power. The feed can be adjusted exactly as required, and by a simple interchange of sieves, any grade of tea can be dealt with. Another very important point is that the cutting rollers can be withdrawn and exchanged for others with a different mesh in an instant.

As a further protection against nails getting into the machine, it is fitted with a triple knife gear. Should a nail or other metal substance get through to the knives, it cannot damage them, as by an ingenious automatic arrangement, it is immediately passed through. If the electric magnetic nail extractor referred to above is fitted to the machine, the nail would, of course, not get into the machine at all. This triple knife arrangement is therefore in that case an additional precaution.

The blending, milling and sifting machinery herein described can be either used separately or combined as a complete unit. Such an installation is shown by illustration No. 3 which is described as a two floor type installation. As will be seen, the sifting and milling machine is installed on the upper floor. This discharges into a hopper which in turn discharges into the blender below. The blender then discharges into bins on wheels, or into whatever form of receptacle is used.

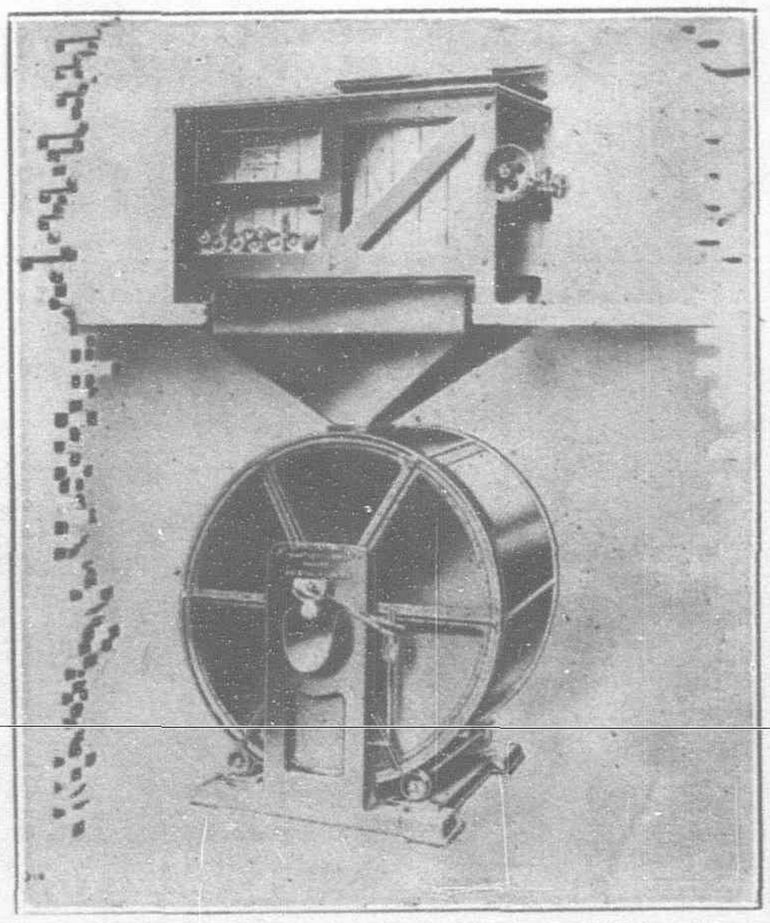
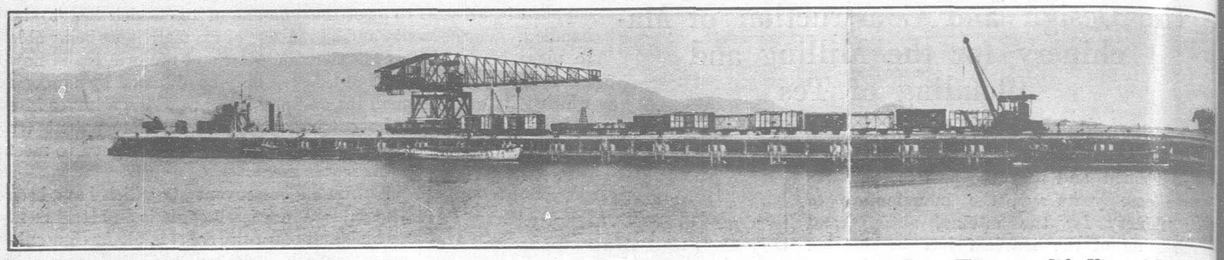


Fig. 3. Two floor type installation of Blending, Milling and Sifting Machienry

This is only one of the ways in which the machinery can be arranged. In the case of a one floor building the tea, after passing through the milling and sifting machine, is raised by a conveyor elevator into an overhead hopper which discharges into the blender.

Messrs. Henry Pooley & Son, Limited, have issued a new catalog which gives detailed descriptions and many illustrations of all the Bartlett tea machinery.



Prai River Wharves: Side View of Jetty—Basin

The Prai River Wharves

By James Brown, M. Inst. C.E.

AS this paper is only intended to describe the works at Prai from an engineering point of view it is not necessary to say much about the history or policy of the scheme.

It may be mentioned, however, that even before 1912 when the Prye Dock property was acquired by the F.M.S. government, the wharfage and accommodation for separate shipping at Prai was known to be quite inadequate to deal with the constantly increasing traffic and the government, in connection with the railway department of the northern states of Malaya, and in view of the linking up of their railway system with the Siamese railways, decided to extend and greatly to enlarge the existing wharves, so as to provide a terminal port where the largest seagoing vessels frequenting the port could come alongside the wharves and discharge directly into railway wagons, or into the transit sheds on the wharves.

Various schemes had been suggested and early in 1913 Messrs. Coode, Matthews, Fitzmaurice and Wilson, the consulting engineers to the government, were asked to examine and report on these schemes.

As no survey or records were then available a preliminary survey of the port was made and soundings and borings, etc., were undertaken, and in 1914 the engineers reported favorably on the scheme for the extension and improvement of the wharves suggested by Mr. Anthony, the chief engineer and general manager of the F.M.S. Railways.

Drawings were prepared, but the European war intervened and nothing was done until the end of 1917, when Messrs. Topham, Jones & Railton, who were then completing the works of the Empire Dock and the Tanjong Pagar Wharves at Singapore, found themselves in a position to tender for the works.

At the time it was practically impossible to obtain any new or special plant required for the work, and it was only because Messrs. Topham, Jones & Railton had their Singapore plant on the ground that they were able to undertake the work. It was hoped that, on the conclusion of the war, conditions and prices would become much easier, but this has not proved to be the case, as prices of materials, plant and wages continued to rise for a long time after the signing of the armistice.

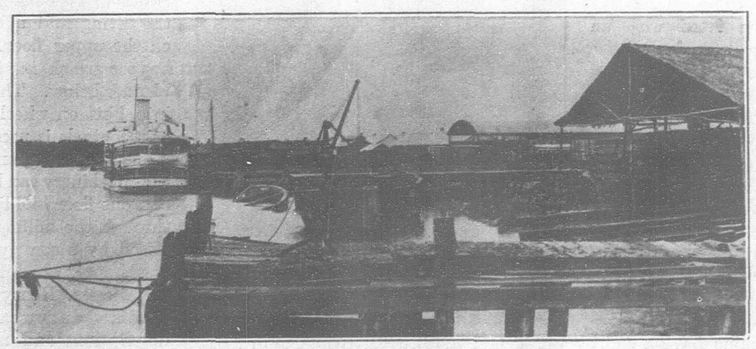
Work was begun in May 1918, and Messrs. Topham, Jones & Railton are entitled to a great deal of credit for the way they have carried on the work in face of continual difficulties.

Several additions have been made to the works since the contract was signed and these works now include :—

1. A reinforced concrete jetty of 1,100 feet in length at the mouth of the Prai River.
2. The widening and reconstruction of the existing wharf 600 feet in length (a prolongation upstream of the jetty).
3. A new coal wharf 900 feet in length in a further prolongation upstream, these three works providing a total frontage to the river of 2,600 feet with a depth of 30 feet below low water.
4. A lighter basin on the south side of the jetty 1,100 feet in length with a depth of 16 feet at low water.
5. Dredging the channel and approaches to a width of 500 feet and a depth of 30 feet.
6. The reclamation of adjoining swamps and foreshore with the dredged materials to the extent of about 170 acres.

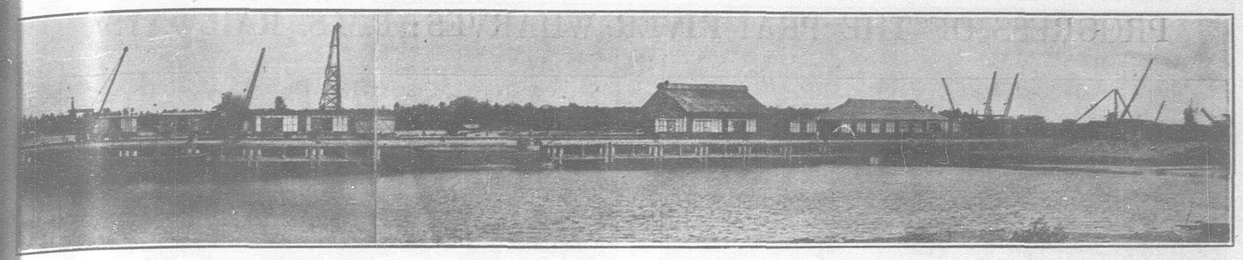
1. Reinforced Concrete Jetty

The borings made in 1914, and again in 1917, showed that underlying the river mud there is an extensive layer of sand at an average depth of about 55 feet below low water level, and going down to a great depth. Later borings made in search of water penetrated continuous layers of sand and gravel of varying degrees of coarseness to a depth of 320 feet below low water, where a hard igneous rock was encountered.



Prai River Wharves: Looking East along Water Front from Corner of old P.H.B. Slipway, June 7, 1918.

It was decided to make the foundations of the jetty and wharves in this layer of sand and the jetty designed is a massive reinforced concrete structure carried on concrete cylinders sunk through the mud into the sand strata. There are 45 rows of these cylinders spaced 25 feet apart centre to centre with seven cylinders each row spaced 22 feet centres, in the width over all of 142 feet.



ide—from South Reclamation; January 5, 1923

The cylinders are made of 5:1 mass concrete 8 feet 6 inches external and 5 feet 0 inch internal diameter swelling out into a cutting edge ring of 3:1 concrete 11 feet 6 inches external diameter which provides a greater bearing area on the foundations and lessens the skin friction in sinking. They are built up of rings made in the blockyard and matured for three months before being used, each ring, generally 5 feet in depth, toothed into its neighbor above and below. They are sunk from a temporary staging through steel guide sleeves set accurately in position and truly upright, at first by their own weight as the mud is removed from the inside by grabs, and later by the additions of rings of cast iron kentledge weighing 5 tons each. When sunk to the required depth of 2 feet into the sand each cylinder is cleaned out by divers and loaded up with 100 tons of kentledge and is required to stand for 48 hours under this load after all movement has ceased.

After they have passed the loading test the kentledge is removed and a compensation ring is made to measured dimensions so as to bring the tops of all cylinders to a true and uniform level. On top of this ring is a special cap capable of a slight adjustment for alignment which completes the cylinder at a level of 2 feet above low water, and at this level the reinforced superstructure is commenced. After the caps have been placed and any silt that may have accumulated in bottom of the cylinders cleaned out by divers, the whole interior is filled up with mass concrete of 6:1 quality deposited in hopper bottomed skips lowered to the bottom before discharging so as to avoid dropping the concrete through the water. As a further safeguard against the disturbance of the cylinders on any of the horizontal joints through the impact of vessels coming alongside, the concrete hearting has been strengthened by placing tram rails of 90-lbs. per yard section vertically in the concrete on each side of the cylinder.

Before passing to a description of the superstructure it may be mentioned that the prescribed test load of 100 tons, additional to the weight of the concrete itself, has been borne perfectly by every cylinder and is equal to a load of 6.8 tons per square foot on the foundations.

This is a load actually borne by the foundation strata, and is not calculated by any formulae, and as the ultimate load due to the weight of the structure and the deck loads is not expected to exceed 4¼ tons per square foot there would appear to be a very safe margin. The total weight of the structure itself is 103,000 tons or three tons per square foot on the foundations.

2. Reinforced Concrete Superstructure

The reinforced concrete beams are moulded in the yard and matured for three months before being set in the work.

The concrete consists of 90-lbs. of cement to 1½ cubic feet of sand and 2⅝ of crushed granite to a gauge of not more than ⅝ inch and not less than ⅛ inch. The finer material (less than ⅛ inch) is left in and considered as sand in the mixture. Special care has been taken to obtain a sound dense concrete as nearly impermeable as can be obtained which will prevent moisture reaching the steel and setting up corrosion. Test cubes are made from the mixture prepared for every beam, and several of these have been sent to England for testing purposes. They show a strength in compression of 3,600-lbs. per square inch at three months old and an average weight of 145-lbs. per cubic foot.

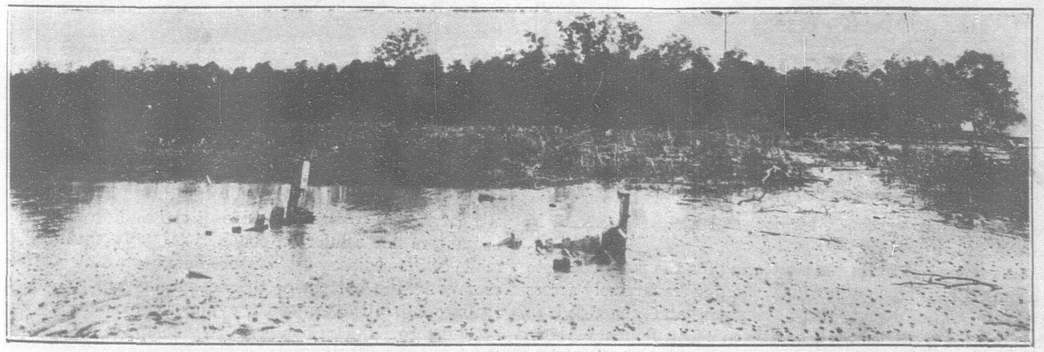
The cement is of English manufacture to the British standard specification with an initial setting time of not less than fifty minutes and a final setting time of not less than five hours.

The minimum cover of concrete allowed over the steel bars is 1½ inches in the beams and ¾ inch in the flooring slabs. As an additional precaution against any moisture reaching the steel bars, the surface of all reinforced concrete above the level of high water of neap tides is painted two coats of coal tar, which must be quite free from acidity. It has been found that damage from corrosion most frequently occurs above the level stated.

In building the structure the first beams placed are the lower fender Walings which rest on cylinder caps on the frontage and end of the jetty tying the cylinders together longitudinally.

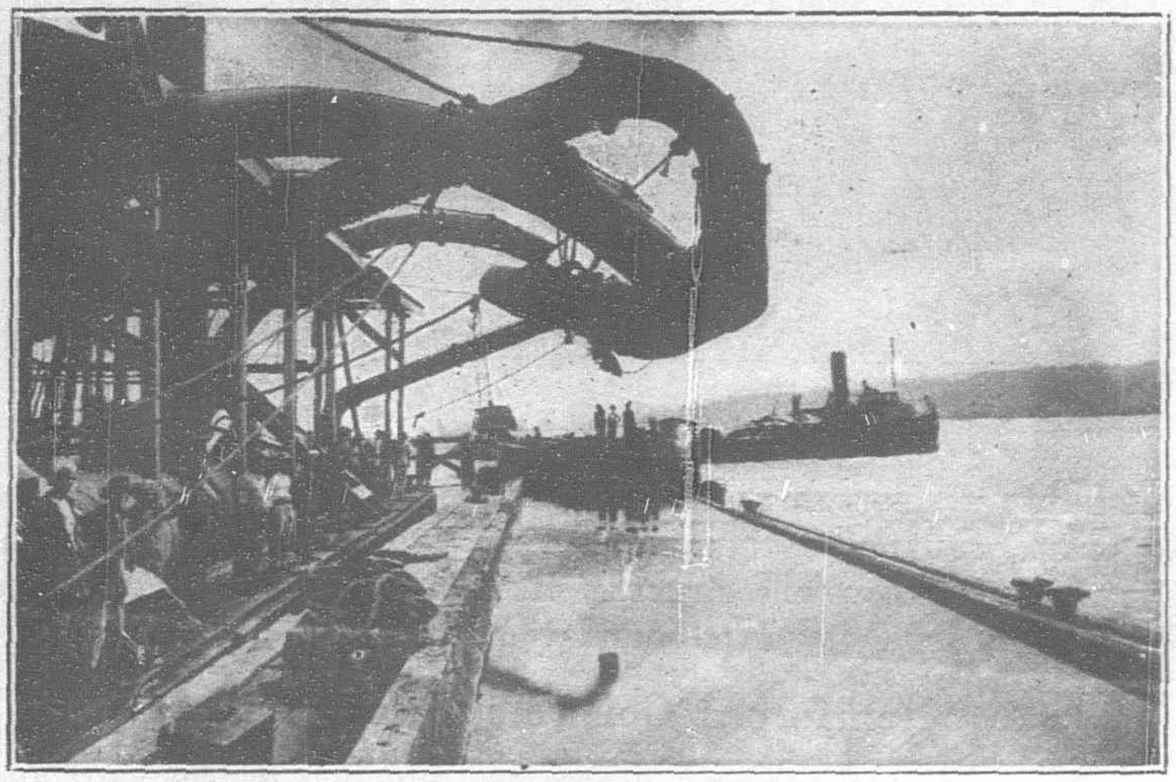
They are moulded with horizontal diagonal struts on the back of the beams the tail ends of which are housed into the mass concrete capping beams.

Every alternate front cylinder is braced to the second row by diagonal struts let into the cylinder caps and the end bays of the

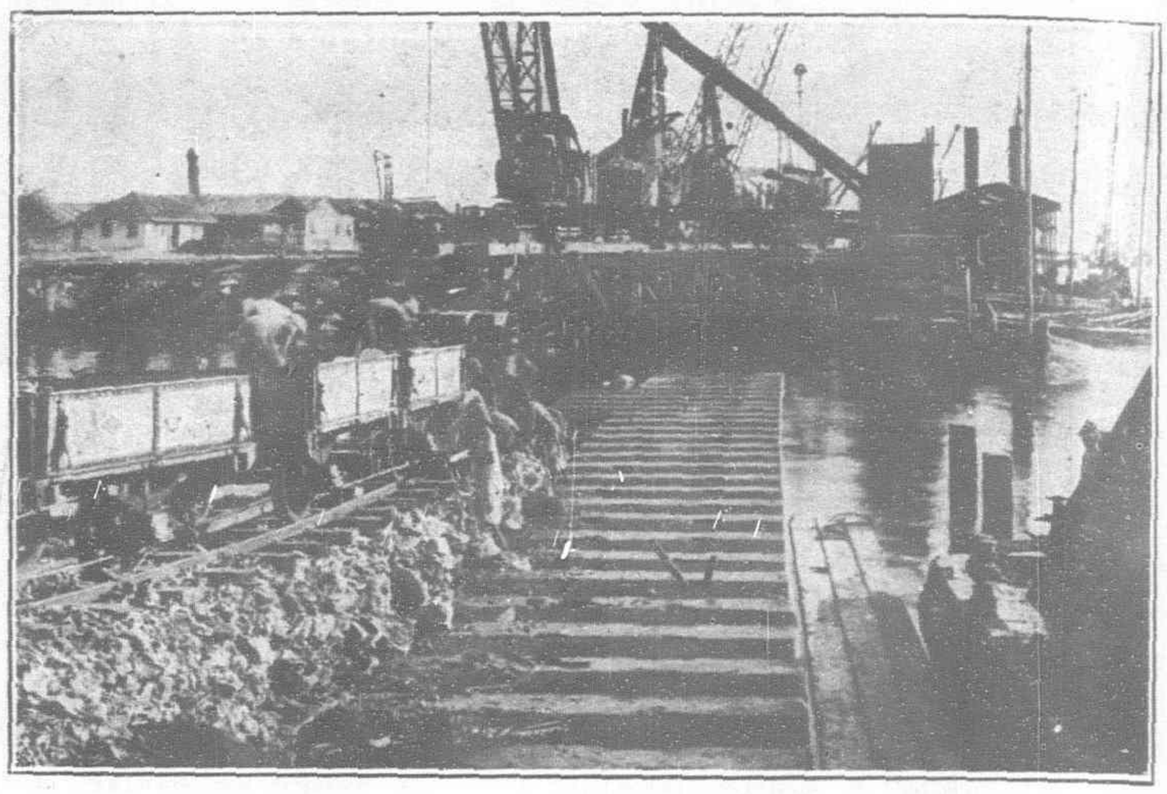


Prai River Wharves; Site of Lighter Basin Looking West from end of Old Retaining Wall: June 6, 1918

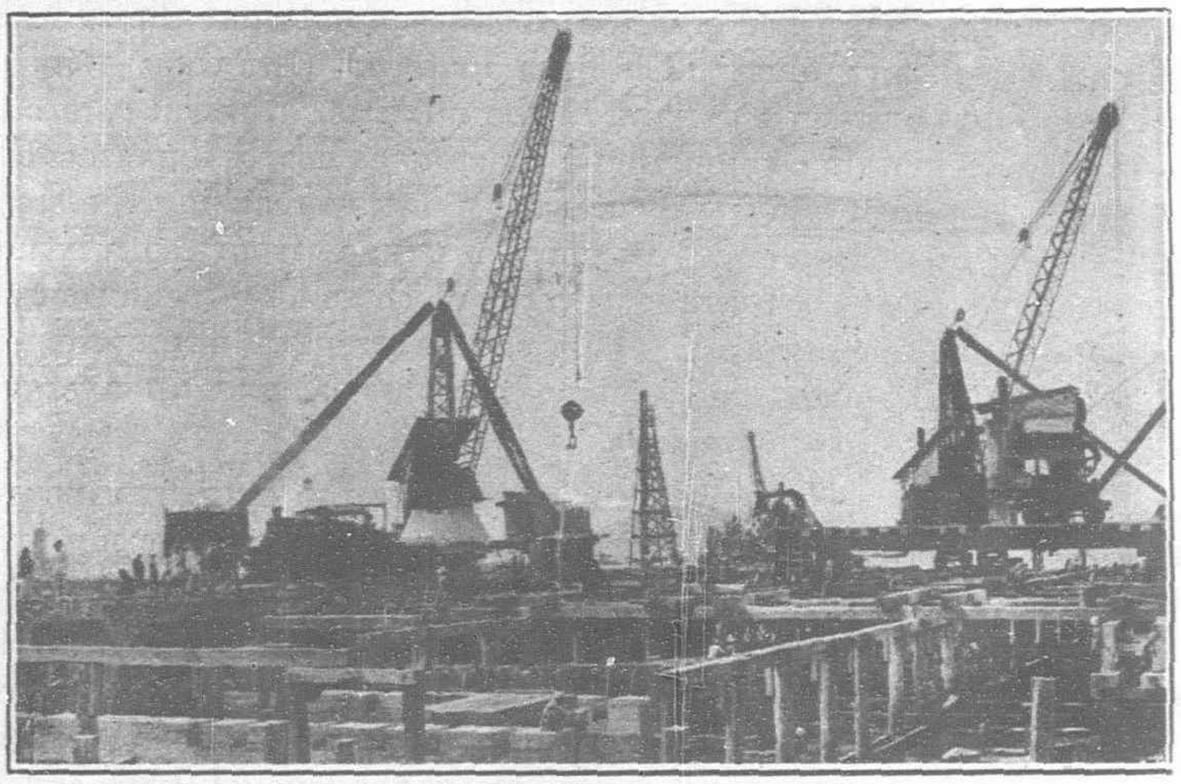
PROGRESS OF THE PRAI RIVER WHARVES: F.M.S. RAILWAYS



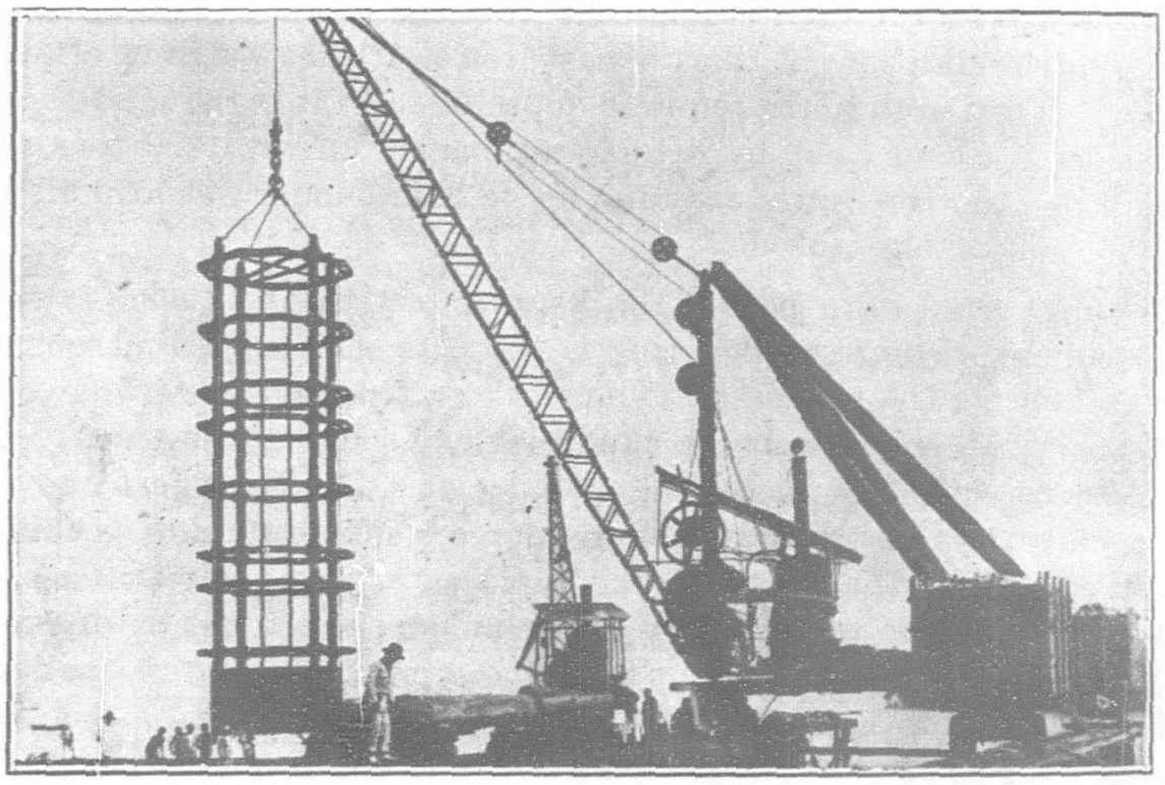
Dredged Material in Barge alongside Pumps at Reclamation: Oct. 6, 1919



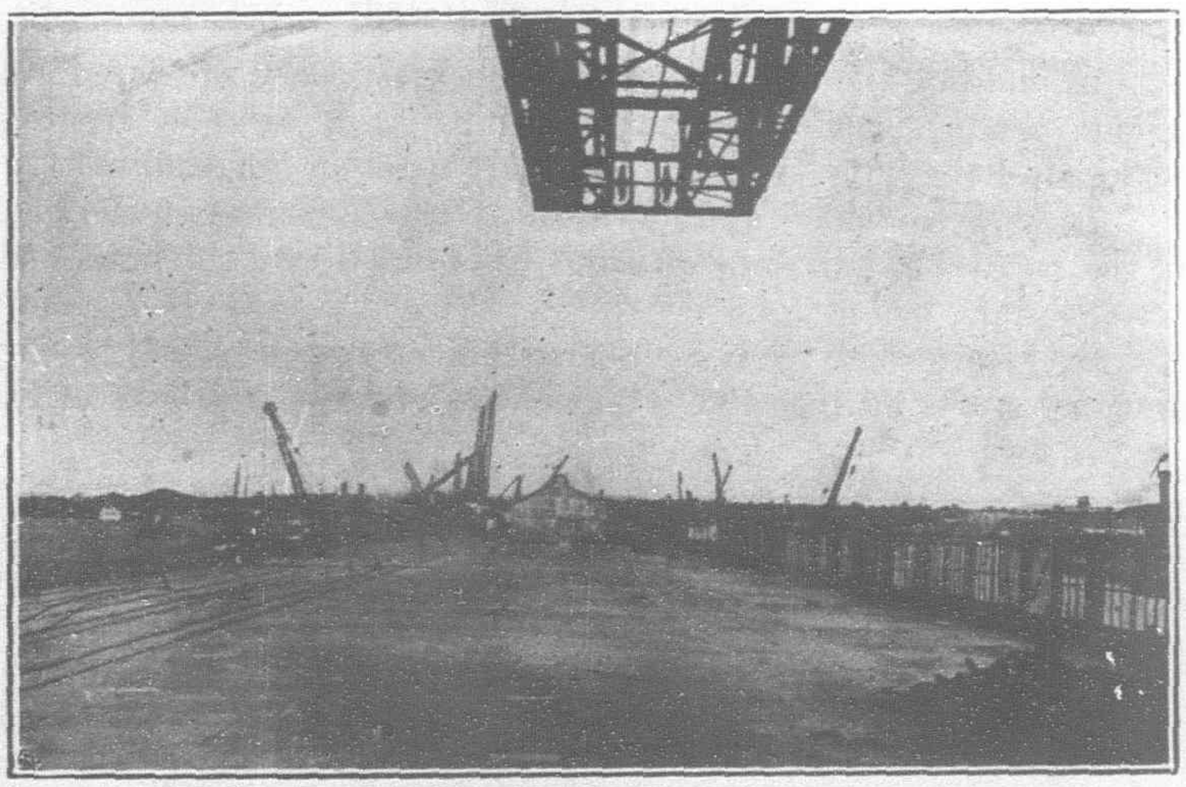
Blockwork Well Showing Top of Blocks at Low Water: May 9, 1922



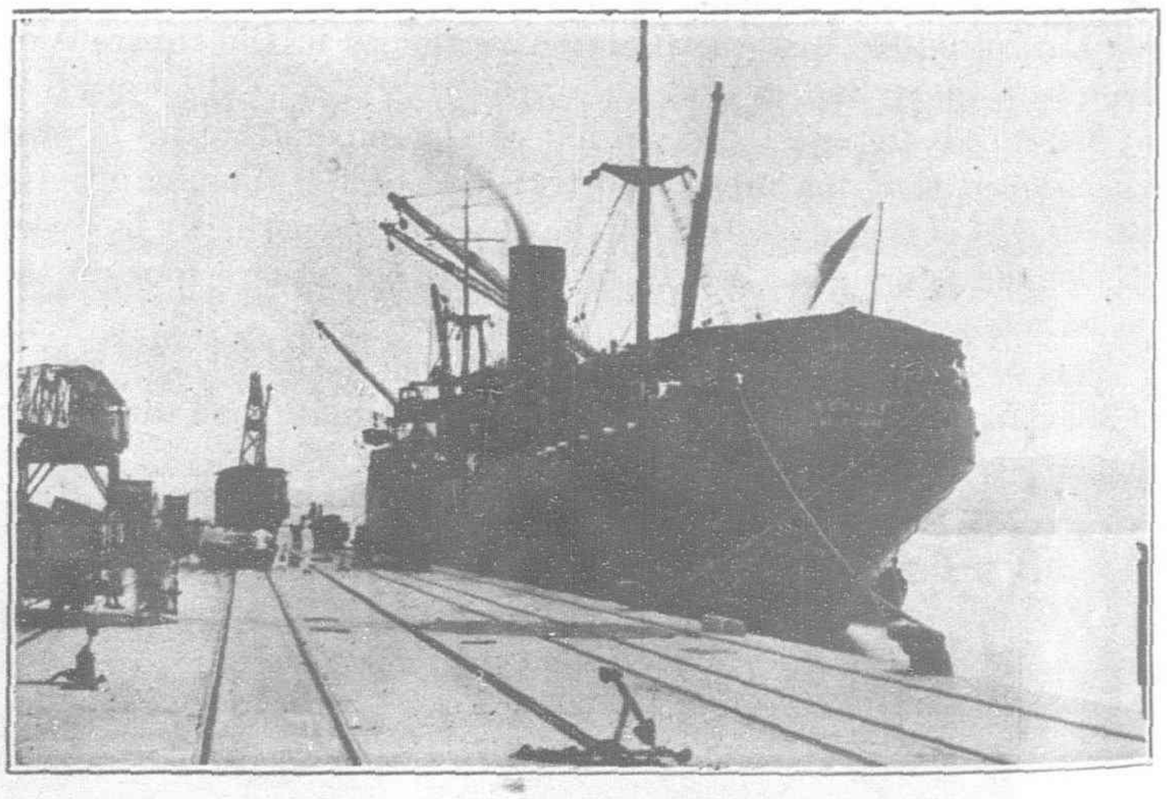
Shore End of Jetty Showing Progress of Concrete Capping Beams, etc.: Dec. 27, 1919



Wharf Widening: Pitching Steel Guide Sleeve for Sinking Cylinders: June 6, 1919



View of Deck of New Jetty, looking East: Sept. 4, 1922



Discharging Cargo from First Steamer Alongside New Jetty: Feb. 17, 1923

jetty are specially strengthened by diagonal and cross struts in the same way.

The next process is to fix the shuttering for the mass concrete capping beams, 3 feet 6 inches in width, running transversely across the jetty on the top of every row of cylinders, and concreted *in situ*. The concrete is carried up generally to 8 feet 9 inches above low water, but where special loads have to be reckoned with they are carried up to the underside of the reinforced decking. These beams are not reinforced concrete properly speaking as they are made of the ordinary 6:1 mixture but they are strengthened by rail cramps in the bottom of the beams fixed in rail collars let into recesses left in the top of the cylinder caps, and by five steel bars of $1\frac{1}{4}$ inches diameter bent so as to take up the tension and shear in the beams.

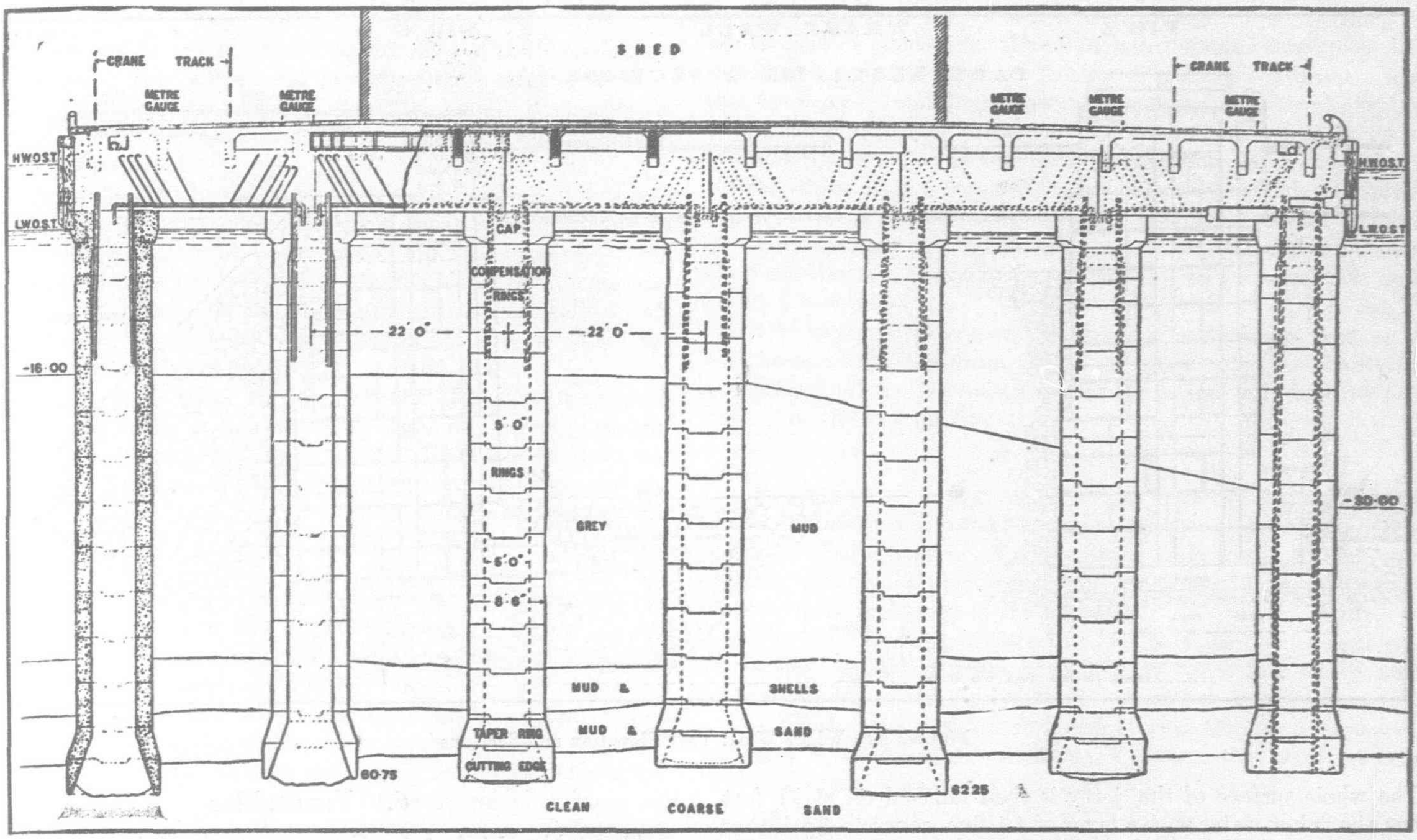


Fig. 3. Typical Cross Section of Jetty

Each beam 22 feet in length is concreted in one operation and formed with a grease joint over the centre of each cylinder.

After the capping beams have been concreted, the deck beams are set in recesses left for them in top of the capping beams. They are bedded in cement compôt and the ends concreted up solidly. These beams as well as the fender Walings are made continuous by the overlapping of the reinforcing bars and by the insertion of joint bars where necessary.

They are spaced as shown in Fig. 3 and are 3 feet 9 inches in depth at the ends and 2 feet 9 inches in the centre portion, by 12 inches in width and reinforced by $1\frac{1}{4}$ inches diameter steel bars. Extra deck beams are placed where required to support cross-over roads.

A special coping beam is fixed on the frontage and end of the jetty, grooved to receive the upper horizontal fender.

All beams having been fixed, shuttering is then prepared for the reinforced concrete decking.

This is 9 inches thickness over the whole area of the jetty, and is reinforced tranversely by top and bottom bars $\frac{5}{8}$ inch diameter spaced 9 inches apart and with intermediate bars under the running roads. In the area occupied by godowns the spacing is 6 inches apart.

The longitudinal bars are $\frac{1}{4}$ inch diameter top and bottom and spaced 12 inches apart.

The crane rails and rails for metre gauge tracks are then laid on top of the 9 inches decking and held in position by $\frac{3}{4}$ inch Lewis bolts $7\frac{1}{2}$ inches long grouted into holes cored in the concrete. They are 60-lbs. per yard B.S.F.B. rails rivetted to sole plates 9 inches by $\frac{3}{8}$ inch which also carry angle guard rails rivetted on.

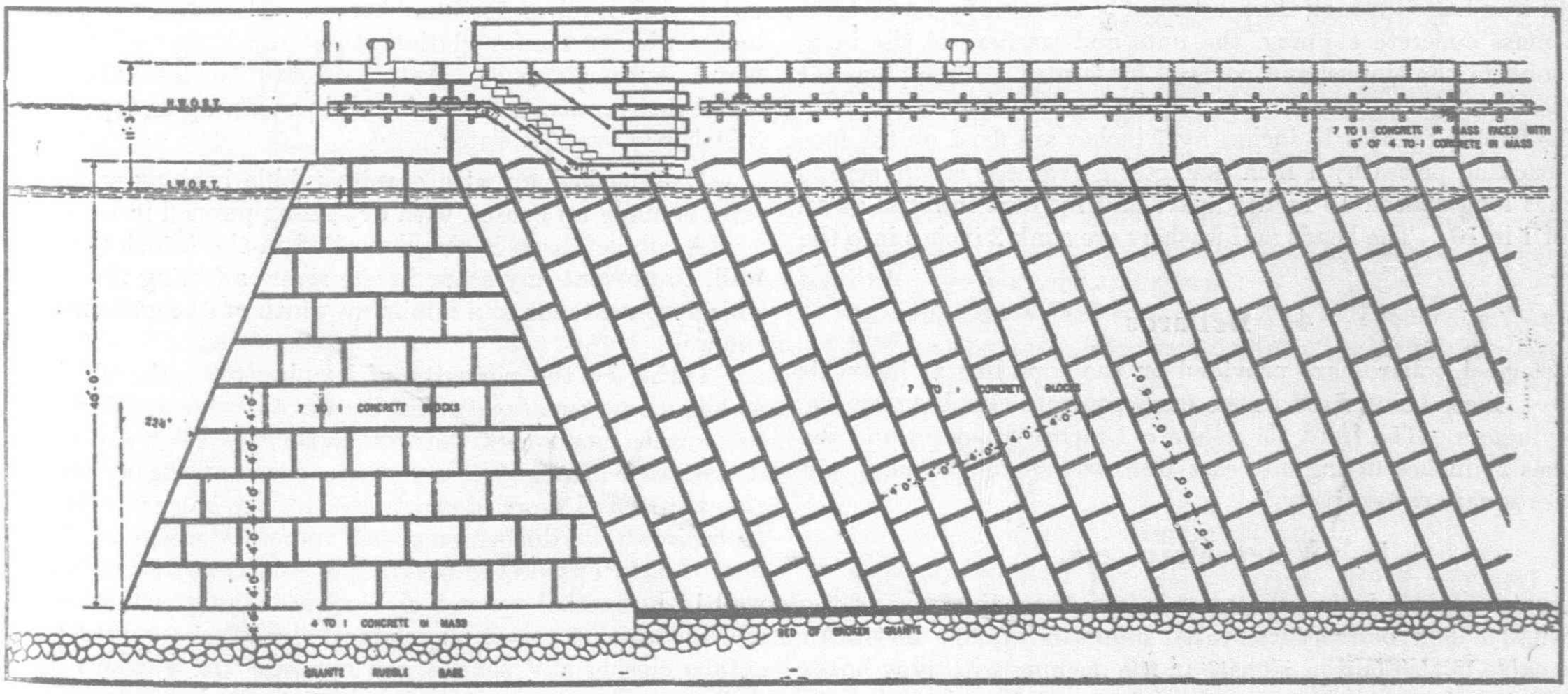
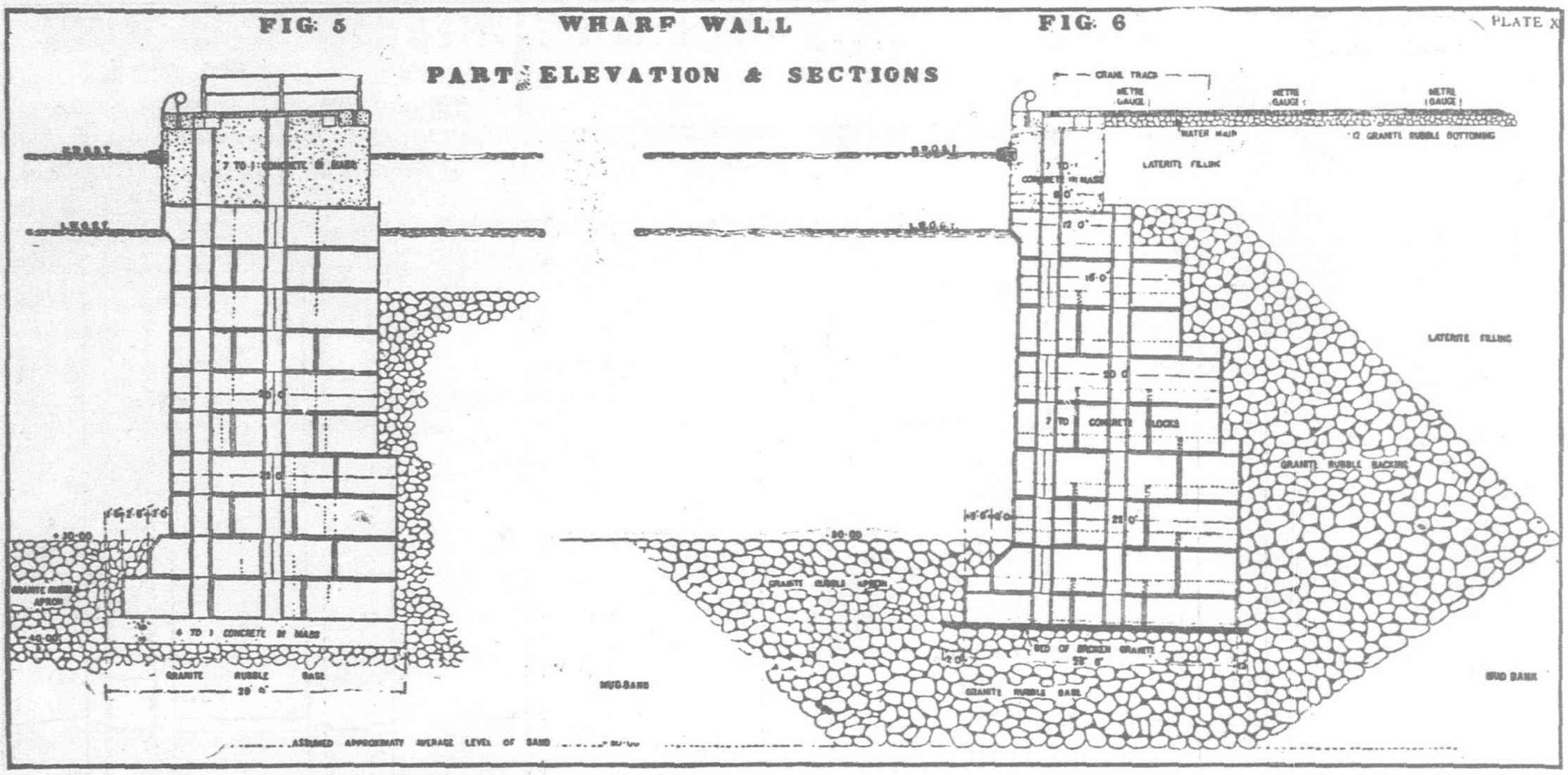


Fig. 4. Wharf Wall: Part Elevation and Sections



Figures 5-6: Wharf Wall: Part Elevation and Sections

The whole surface of the jetty is then finished off at 11 feet 3 inches above low water with a layer of 4:1 fine concrete $3\frac{3}{8}$ inches thick, on which is laid 1 inch of 2 to 1 granolithic of fine granite siftings, screeded off to the reqnired levels and falls, the top layer being laid simultaneously with the lower one and forming one homogeneous mass with it.

The total weight of the reinforced superstucture, including the capping beams is 26,000 tons, 1,200 tons of which are due to the steel reinforcement. The average amount of reinforcement is equal to 10.22-lbs. per cubic foot of concrete, the most heavily reinforced beams being the non-continuous beams under the cross-over roads where the reinforcement amounts to 19-lbs. per cubic foot.

3. Fendering

Fendering of the best quality Ballaw timber is provided on both sides and end of the jetty. Tapered grooves both vertical and horizontal are formed in the mass concrete capping to front cylinders and in the reinforced concrete fender Walings and coping beams to receive the backing piece 14 inches square, shaped to fit the grooves. These are secured by $1\frac{1}{2}$ inches diameter galvanised wrought iron bolts through the reinforced beams and by Lewis bolts in the mass concrete capping, the nuts and washers of the bolts being sunk in the timber and covered by turned Ballaw plugs set in red lead.

The rubbing pieces 14 inches by 7 inches are fixed on the face of the backing pieces by 1 inch diameter galvanised coach screws 12 inches long spaced 18 inches apart and inclined inwards at an angle of 1 in 10. The heads and washers are sunk 2 inches into the timber.

4. Bollards

Cast steel bollards are provided on the cope line at intervals of 75 feet, these being fixed in the mass concrete capping over the front cylinders. The front tie rods are 2 inches diameter and the back ones $2\frac{1}{2}$ inches fitting into cast iron washers of 15 inches and 18 inches square respectively.

5. Water Main, etc.

A water main 7 inches diameter is laid along the front of the jetty with 3 inch ball hydrants at intervals of 200 feet. An electric cable is also laid in a chase in the decking with plug boxes for connection to the electric cranes at 50 feet intervals.

6. Turntables

Turntables 14 feet in diameter are fixed in wells specially formed in the reinforced concrete superstructure, on the two cross roads (between the sheds, and at the end of the jetty) for the transfer of single wagons from one track to any other.

7. Wharf Widening and Coal Wharf

The wharf widening and the coal wharf which extend for 1,500 feet upstream from the land end of the jetty were originally intended to have been made of the same design as the jetty, i.e., of concrete cylinders and reinforced concrete superstructure, but owing to the necessity of supporting the ground at the back of the wharves by a rubble mound, and the risk of displacing the cylinders in the soft mud bed while depositing the rubble, it has been thought advisable to substitute a concrete block work wall of the design shown in Figs. 4, 5 and 6,

The wall is of the sloping blockwork type, the blocks 4 feet in thickness in slices set at an inclination of 67-in. to the horizontal or a granite rubble seating, which is deposited in a trench dredged out to the level of the sand strata. The blockwork is 26 feet 6 inches wide on the foundation course and 12 feet wide at the top, 2 feet 6 inches above low water. Above this level the wall is built of 7:1 mass concrete 9 feet 0 inch in widtn up to cope level 11 feet 3 inches above low water.

It is backed up with granite rubble backing and the ground level is made up behind with dry filling punned in layers.

A rubble apron is also deposited in the trench in front of the wall, to prevent any scour in the river affecting the foundations. This apron extends to a minimum width of 35 feet from the face of the wall.

Owing to the necessity of keeping open the old Prye Dock as long as possible, and retaining the existing screw pile wharf for use until a portion of the new works has been put into service, it has been arranged to commence work at the upstream end of the wharf and work downstream to the dock entrance. Then to begin at the downstream end and work upstream towards the dock. This entails the building of abutments at each end of the wall in horizontal courses of blockwork built with a sloping scar end on which to start the sloping blockwork courses, and it also entails closing a V shaped gap opposite the entrance to the old dock.

The method of construction is as follows :—

The river bed is first dredged over the area of the foundations to 38 feet below low water and the temporary staging is then erected on piled dolphins on each side of the wall. By cranes on the staging the trench is then grabbed out to the full width required and down to sand level.

When the bottom has been cleaned out examined and passed the granite rubble base consisting of stones varying in weight between 56-lbs. and 10 cwts. is deposited, up to the level of—37.50. The surface is roughly levelled by divers and a bed of broken granite, of not less than 6 inches in thickness, of stone broken to a 2 inch gauge is spread, levelled and consolidated by divers under the foundation course of blockwork.

The horizontal blocks of the abutment are then placed to correct lines and levels and the whole brought up course by course. The blocks are keyed together by joggles 10 inches in diameter and 2 feet deep filled with 4 to 1 concrete in canvas bags, and the outer blocks are cramped into their neighbors with strong rail cramps let into the top of the blocks. The cramps are fixed by divers and the cramp slots filled up solid with 1 to 1 fine concrete.

When the abutment has been brought up to the height of 2 feet 6 inches above low water, the sloping blockwork begins on the sloping scar face of the abutment, each slice being tongued and grooved into the adjoining slice and built up block by block to top level. The blocks are designed so that they can be handled by the existing plant on the works, the heaviest being 15 tons in weight.

When the wall has been built sufficiently in advance the rubble backing of stones between 5 cwts. and 2 tons in weight is deposited to its full height and work is then begun on the mass concrete wall on top of the blockwork.

The shuttering is set, the top joints of the blocks caulked with jute bagging and the joints grouted up with neat cement.

The tops of the blocks are roughed over with a pick and the concrete is deposited in layers, cross shuttering being provided to cause each layer to break joint with the other. The concrete is of 7 to 1 but is faced with 6 inches of 4 to 1 brought up simultaneously with the mass.

The coping is framed of moulded concrete blocks of 4 to 1 concrete, 3 feet in width and 1 foot 6 inches deep.

The crane road and the three metre-gauge tracks on the river side of the jetty are continued throughout the whole length of the wharves with the necessary cross-over roads and connections to the main line.

Two double-storey goods sheds of 475 feet and 65 feet are to be built on the jetty and one of the same dimensions on the wharf widening, while a coal handling plant will be provided on the coal wharf with stacking ground at the back of the wharf for about 100,000 tons of coal.

8. Lighter Basin

The lighter basin is formed on the south side of the jetty, between the jetty and the southern reclamation. It is 1,100 feet in length by 300 feet wide on the bottom level of 16 feet below low water.

The land side is finished with a dredged slope of 1 in 5 up to ground level, and a berm of about 50 feet in width is left between the top of the slope and the toe of the bund to retain the dredged materials pumped into the reclamation.

From the cope line of the bund steel jetties run out 150 feet to tee heads in the basin alongside of which lighters will be discharged by fixed electric cranes directly into railway wagons, or the goods can be taken into the godowns to be built on the reclaimed area.

The jetties will be constructed with the screw piles and steelwork of the old wharf which has to be dismantled to permit of the construction of the new works.

This old wharf was built in 1911 and a portion of it has already been removed.

The condition of the steelwork is interesting.

The cast iron screws which were imbedded in a sandy clay are in perfect condition. The 6 inches diameter steel piles below the level of the river bed are in almost perfect condition. Above this level and extending upwards to mean tide level the piles and bracing rods were thickly coated with a shelly marine growth, oyster shells and barnacles, and on stripping off this coating the surface of the steel is found to be considerably corroded by pitting, the holes being usually filled up with a blackish powder which can be easily scraped out. The holes are numerous and vary in size from the size of a pin head to an area of $\frac{1}{2}$ to $\frac{3}{4}$ square inch and to about $\frac{3}{8}$ inch in depth.

The edges of plates and angles in the bracings, and around bolt holes above low water level are much worn by oxidisation and almost all the tie rods and bracing beams will have to be renewed for the new jetties.

9. Dredging

Probably the largest item of the contract is the dredging of the channel and approaches to the wharves, and of the lighter basin, a total quantity of $2\frac{1}{4}$ million cubic yards having to be removed and in addition any siltage which may accumulate during construction, and term of maintenance.

The river is being widened to 500 feet for the full extent of the works, on the bottom level 30 feet below low water and is finished on the north side of the river with a 5 to 1 slope.

A turning basin of 750 feet radius from the inner land end of the jetty is being formed on the north side of the river to permit of the swinging of vessels entering or leaving the port.

As the amount of silt brought down by the river is very considerable the consulting engineers in their report pointed out that maintenance dredging would be required and this is being provided for. During the construction when the mud is being stirred up in all directions siltage is particularly heavy and there is a heavy deposit where the flood tide meets the flow of the river, but on the completion of the works this should be very much less.

As no interruption to the traffic on the river is allowed during construction it is impossible to pump the dredgings through a pipe line direct from the dredger, and the dredging is therefore being done by a bucket dredger which delivers the materials into specially built mud barges alongside, each carrying about 350 cubic yards.

These are towed to the pumping installation placed alongside the area to be reclaimed and the dredged material pumped ashore.

The pumps are steam-driven centrifugal pumps with a 5 feet diameter disc and suction and delivery pipes of 21 inches diameter. They are placed with boilers and auxiliary engines in a pontoon moored in a prepared berth, and rise and fall with the tides, special knuckle joints being provided on the delivery pipes to allow for the varying height of the pontoon. All machinery on the pontoon is duplicated.

Each pump is capable of delivering over 500 cubic yards per hour at 200 R.P.M. and is driven by a compound engine with 14 inches and 24 inches diameter cylinders and 13 inches stroke, using steam at 150-lbs. pressure.

The water pumps are also centrifugal with 18 inches diameter suction and 16 inches diameter delivery, the delivery pipe being fitted with a flexible tube and nozzle.

The main delivery is a steel rivetted pipe 21 inches in diameter in 16 feet lengths of $\frac{3}{16}$ inch metal, with angle iron flanges for bolting the pipes to each other. It is carried on wooden trestles from the pump delivery to the point at which it is required to discharge the dredged materials—the maximum distance in this case being 2,100 feet.

10. Reclamations

As the dredging of the river channel was a necessary and very important part of this scheme it was considered desirable to utilize the dredged material as far as possible in the reclamation of the low-lying swampy ground, and the shallow foreshores adjoining the works, instead of taking it to sea, and so to provide

land which will be extremely valuable for the erection of godowns, etc., and for the laying out of railway yard and sidings.

The principal area to be reclaimed is the southern reclamation lying to the south of the lighter basin and extending to an area of about 80 acres. This was originally mangrove swamp and foreshore.

One of the chief difficulties of the contract, or at least one requiring the most exercise of patience, has been the building up of the bund to retain the pumped materials. These bunds are tipped banks of stone and earth with a granite rubble facing on the sea face. On the mangrove area not much difficulty was experienced, but on pushing out the bank on the soft mud of the foreshore very considerable settlement occurred and the banks had to be made up continually as the settlement took place. The whole area has now been enclosed, but settlement still continues and the banks still require to be made up in places from time to time.

During the process of reclaiming, the whole area is divided up in nine compartments by cross banks and the filling up of three of these proceeds together, the pumps delivering the mud, which is in a liquid state, into each of the compartments for two days alternately, and while delivering into one, the mud is settling and the surface water being drained off the other two compartments.

In dry weather and with careful draining off of all surface water, the mud dries up pretty rapidly, but in wet weather six to twelve months are required before any work can be done on the surface of the mud.

Six of the nine compartments of the southern reclamation are now completely filled up, the remaining three are almost full and are being left to settle while pumping is going on in the Bagan Luar reclamation on the north side of the river. Over the first compartments locomotives and railway wagons are now being run, these bringing in the dry earth filling which is spread for a depth of about 18 inches over the whole surface before proceeding with the erection of godowns.

The mud in the other compartments is settling and drying out satisfactorily.

It would be interesting and useful to know the density of the mud in its different conditions, as it exists in the bed of the river, as it is delivered by the pumps, and as it finally dries out in the reclamation, but it is extremely difficult to arrive at any accurate figures.

I give the following with some diffidence but believe them to be approximately correct.

Weight of mud per cubic feet as it lies in bed of river	90-lbs.
,, ,, ,, ,, ,, in barge at pumps	84 ,,
,, ,, effluent from pump delivery	75 ,,
,, ,, mud when dried out in reclamation ..	96 ,,

Taking the last figure as the weight of dry mud (although it would probably weigh considerably more if it were absolutely dry) these figures show that the mud in the river bed contains about 19 per cent. of water and 81 per cent. of dry mud. As it reaches the pumps in barges the mixture contains 38 per cent. of water and 62 per cent. of dry mud. As it is delivered from the pumps 66 per cent. of water and 34 per cent. of dry mud, and they also show that 45 per cent. of water is added to the mixture in pumping out from the barges.

This is a very variable figure depending on the stiffness of the mud, and also on the amount of water already in the mixture when it comes to the pumps, and is the result of several tests made at Prai.

In addition to the godowns to be built on the wharves and adjacent to the lighter basin there are several other incidental works which do not come within the scope of the present contract.

The principal of these are the provision of cranes on the jetty and wharves for the handling of cargo from the holds of vessels into railway wagons or into the godowns. They are to be capable of handling three tons and are of the portal type on a 15 feet gauge track, and will be worked electrically, the power being supplied by leads from the plug-boxes set in the decking at intervals of 50 feet on the main cable from the power house. The turntables, and coal handling plant will also be worked electrically and there will be an extensive lighting system for the wharves and for the town.

The plans for a power station are now in hand, and it is hoped to start work on the foundations very soon.

The station is situated at the end of the lighter basin in a convenient position for obtaining a supply of condensing water from the river and for its discharge through a short culvert into the basin. As there is about 5 feet of mud here the building will be carried on piles driven down to the sand, their tops let into a concrete raft extending over the whole area of the buildings and on which the generators and other machinery will be placed and the building erected.

It is proposed at first to instal two sets of turbine generators of 1000 k.w. capacity each and one of 300 k.w. on the 3-phase alternating system with provision for a future set of 5,000 k.w. Provision will also be made on the same foundation raft for the boilers, transformers and other plant and a space is reserved for a pulverised fuel plant.

As the building of the new wharves entails the closing and filling up of the old Prye Dock and Slipway, a new dock and slipway will be built on the area known as the northern reclamation immediately north of Prai railway station. Drawings and specifications have been prepared and work will start as soon as government can see its way to proceed with these works.

The dock proposed is to be 480 feet in length with an entrance 65 feet wide and with 21 feet of water on the sill at L.O.W.S.T. The slipway will be capable of handling vessels of 1,000 tons dead weight, the rails being laid at an inclination of 1 in 22. A sand foundation for these works will be obtained as in the case of the jetty and wharves, but, owing to the depth of the overlying mud, bearing piles will be required to carry the new works.

Swiss Locomotives for N.E.I. Railways

IN the autumn of 1916, a contract was concluded between the Dutch colonial ministry at the Hague and the Swiss Locomotive and Machine Works, Winterthur, for the delivery of 14 2 C2 tender locomotives with Schmidt's superheater. The engines were shipped from Holland to the Dutch Indies, especially for the State Railways at Java (destination Tandjong Triok, a harbor near Batavia.)

The program of the suburban traffic provided for a traction power of 6,000 kg. on a gauge of 1,067 mm. This corresponds to the conveyance of a train of 400 tons on up gradients of 5 per cent. and in curves with a radius of 180 m.

The speed on the above-named gradients is 50 km. the hour. The locomotives are likewise intended to run on curves of 120 m. radius and 20 mm. widening of the gauge. The maximum speed on the level is fixed at 80 km. per hour.

The locomotives are provided with Marcotty smoke consumers. A superheater on Schmidt's system permits of a steam temperature of 350 Centigrade.

The automatic vacuum brake, steam brake and hand brake act with 60 per cent. of the adhesion weight (20 t.) on the front of the driving and coupling wheels.

Besides these engines 2 C 1 superheated steam express locomotives were built, with four-axled tender were supplied in large numbers to Java, and, after drawings by the railway company, several 1 D superheated goods train engines with four-axled tender.

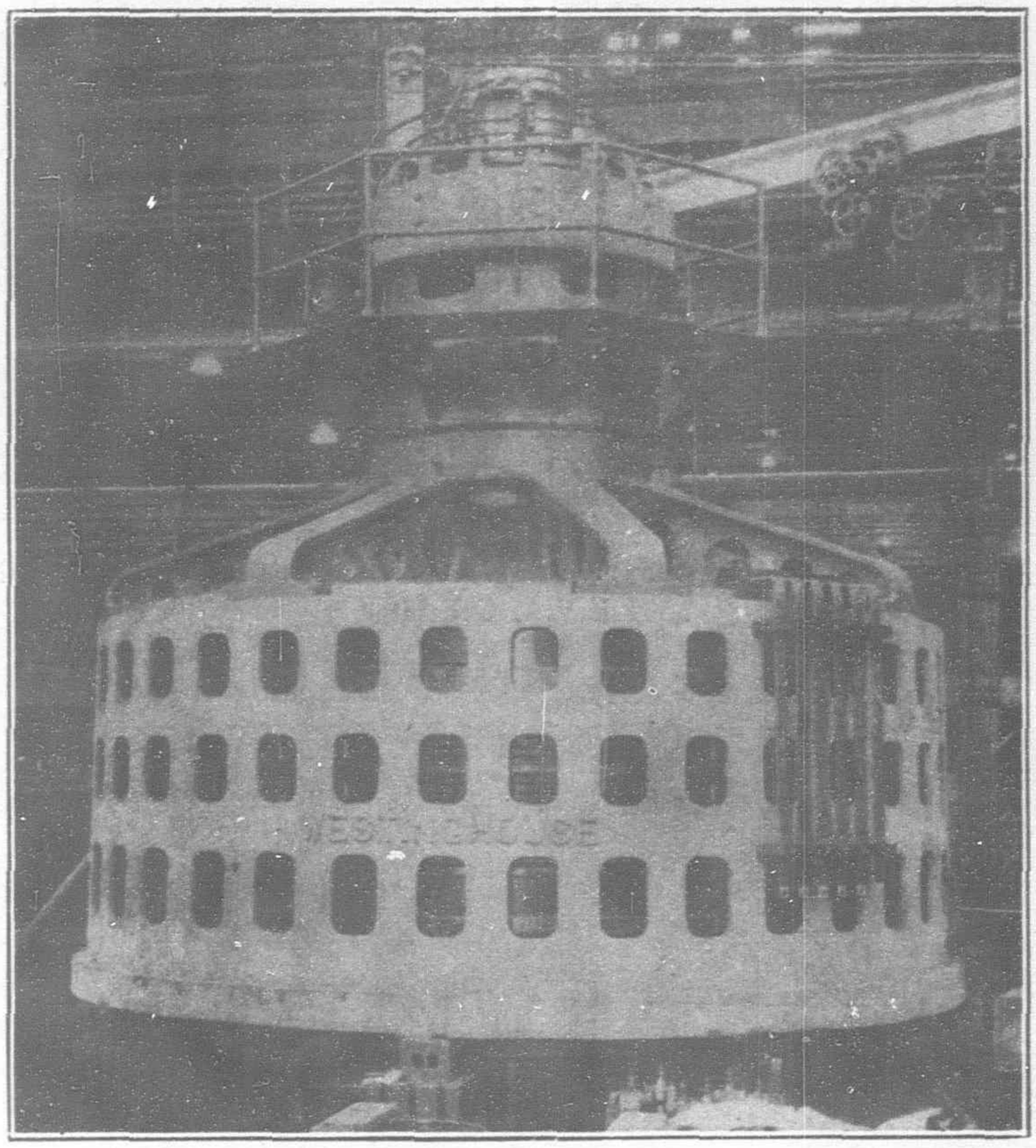
For Sumatra, combined cogwheel and adhesion engines in the Winterthur style were delivered in two styles of execution, i.e., as O-D-1 wet steam locomotives and as O-E-O superheated locomotives. The latter type has proved especially efficient.

Electrical Developments in Japan, 1922

By H. C. Huggins

THE past year was one of remarkable electrical development in Japan. The outstanding tendencies were the amalgamation of small concerns in the large power supply companies, and the growing electrification of steam railways, with a return to the building of steam power plants. This last phenomena was due entirely to the decreasing costs of coal, making it profitable again to generate power by it; and also to the slowness with which hydro-electric power plants are erected in this country, causing a long tie-up of funds, in a country when finances have been at low ebb the past two years, and working capital difficult to obtain even at interest rates which would paralyze industry abroad.

The greatest installation of the year was completed by the Osaka Dento K.K. (Osaka Electric Light Co., Ltd.), at Nishino Shimono-machi, in Osaka city, where a steam power plant generating 20,000 kilowatts was erected to supply light and power in Osaka city. The second largest steam plant erected belongs to the Daido Denryoku K.K. (Daido Electric Power Co., Ltd.) and this too has been erected to supply power and light in the districts around Osaka where the demand for electric power has been steadily on the increase even in these three years of industrial depression since the panic.



15,000 KV-A. 250-300 R.P.M. 50-60 CYCLE WATERWHEEL GENERATOR

This photograph shows one of the Momeyama generators of the Daido Company assembled in the Westinghouse Works. This machine is to operate either at 250 R.P.M. for 55-cycle service, or 300 R.P.M. for 60-cycle service. It is provided with the Kingsbury thrust bearing surmounted by a direct connected exciter.

A total of 12 leads is brought out from the stator of the generator so that the stator winding can be connected in straight star for 50-cycle operation when running at 250 R.P.M. or arranged for interconnected star for 60-cycle operation at 300 R.P.M. developing essentially the same voltage—6,600, at the two speeds, and the same field excitation.

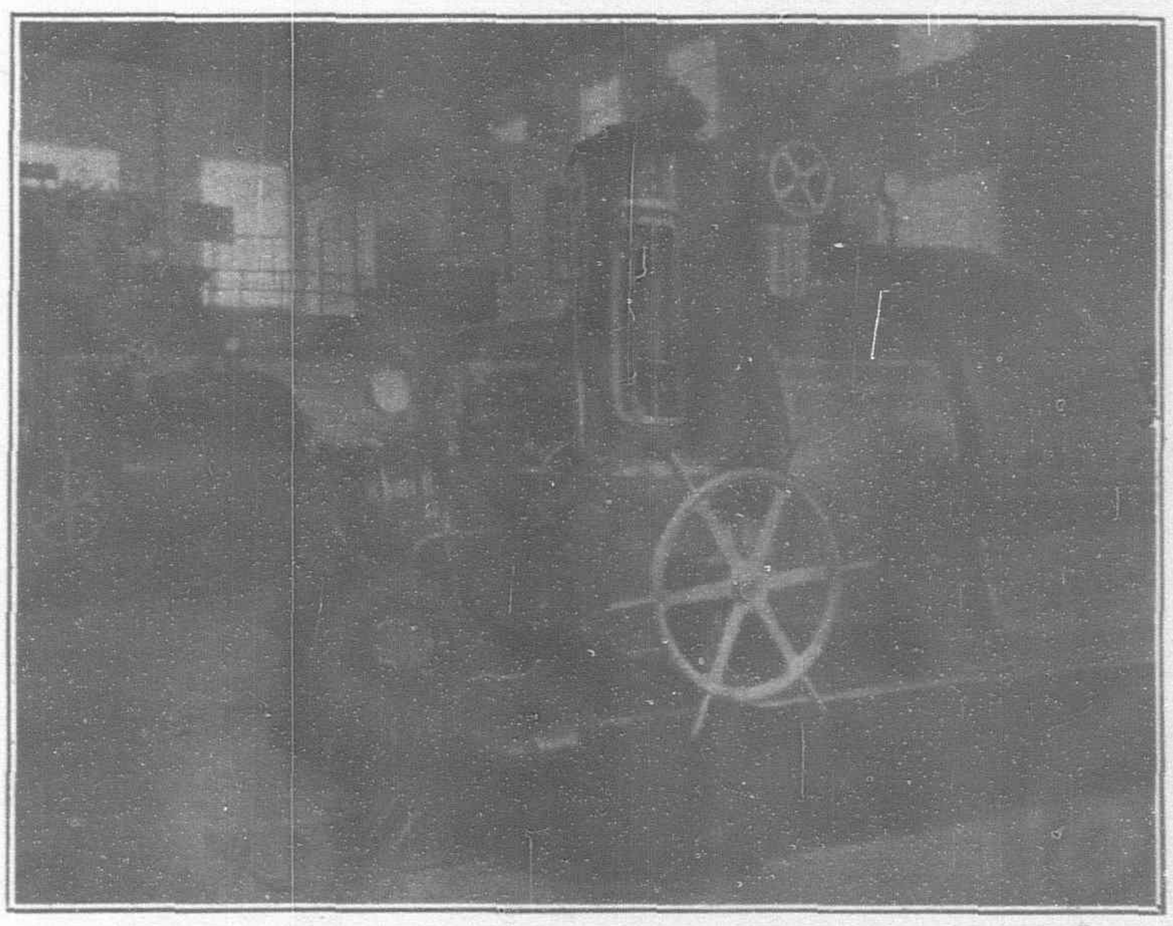
The Sakagami Kyuko Dentetsu K.K. (Sakagami Express Electric Railway Co., Ltd.), of Hyogo prefecture, completed a 10,000-kilowatt steam plant to supply power for its electric lines in Hyogo prefecture.

There were few large water power installations completed; the most important being the plant of the Tomino Suiryoku Denki K.K. (Tomino Hydro-Electric Power Co., Ltd.), on the Kiso River, generating 9,200 kilowatts. The next largest was the plant of the Chugoku Suiryoku Denki K.K., in Okayama prefecture, located on the Yoshii River, generating 6,000 kilowatts. The interesting point about these installations is that they were practically all completed with Japanese-made machinery.

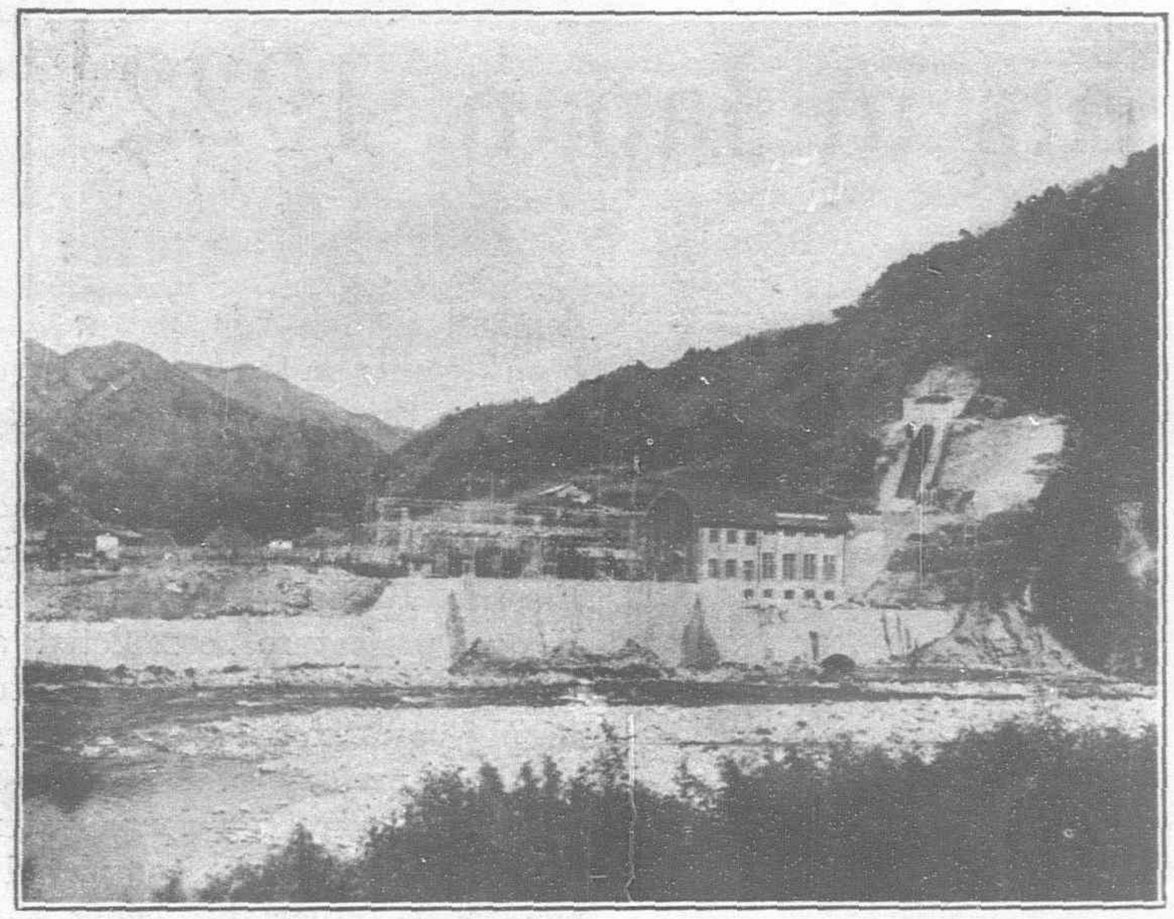
Of a total of 128,824 kilowatts completed and started up during 1922, 85,465 kilowatts were hydro-electric, 43,024 kilowatts steam power, and 335 kilowatts gas plants.

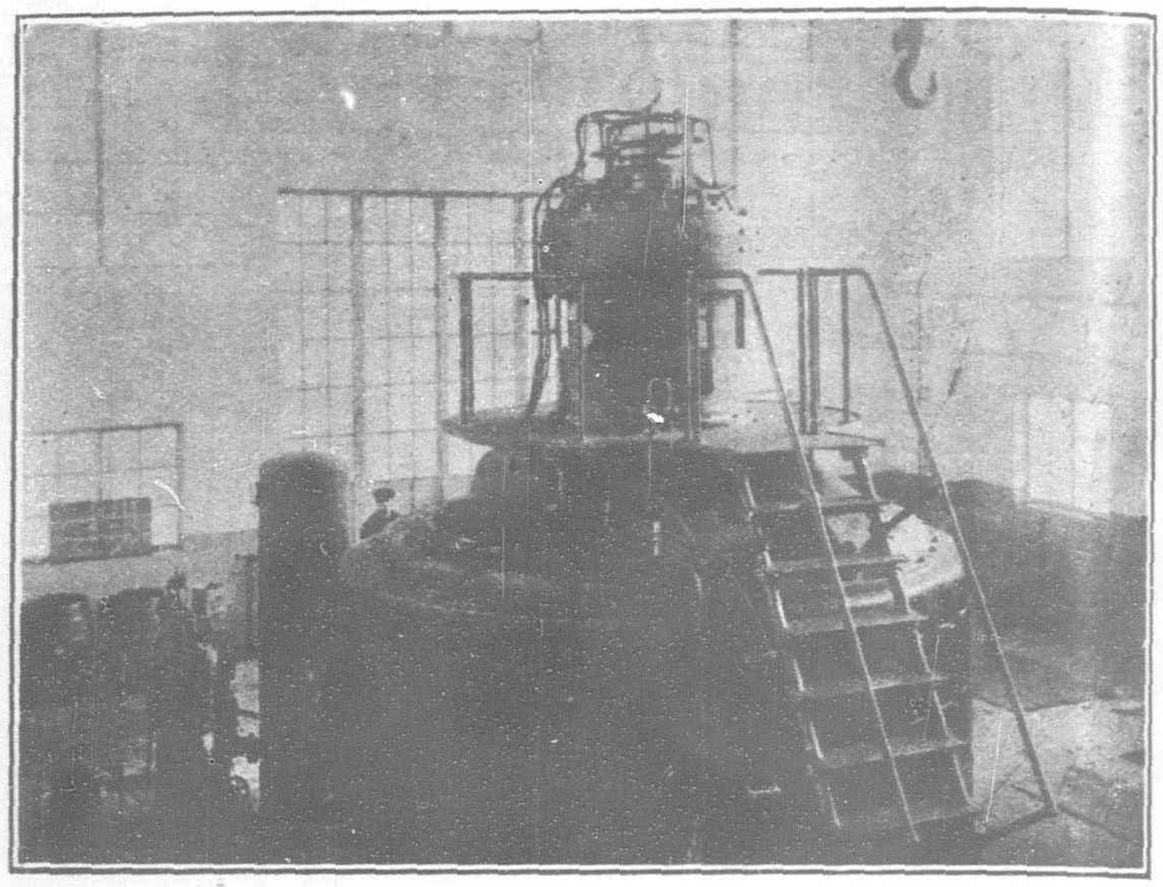
The mergers reduced the number of companies engaged in electric enterprises from 843 at the beginning of the year to 827 the end of December, with an

Kyushu Hydro-Electric Company: Two 5,000 K.W. Turbo Generators: Escher Wyss & Company "Zoelly" Turbines



Kyoto Electric Company: Steam Plant, Escher Wyss "Zoelly" Turbines with Brown Boveri Generators





The Tokise Power House of the Bisan Hydro-Electric Company: Equipped with a 10,000 H.P. Allis Chalmers Turbine and Allis Chalmers 7,500 K.V.A. Generator

increase in capital invested of Y.288,287,569. The following table shows the number of companies engaged in each branch of electric supply, and the capital invested at the end of 1922:—

	Number	Capital invested
Power and light companies ..	.. 709	Y.1,149,818,093
Railways	.. 65	157,349,646
Supply and railways ..	.. 53	134,767,752
Total	.. 827	Y.2,259,696,893

There was a decided increase in the number of companies operating electric railways, from 51 in January to 65 in December, the capital invested increasing from Y.121,716,535 to Y.157,349,646, an increase of Y.35,633,111. This was largely due to the favorable business results shown by steam railways already electrified, and to a very strong government propaganda for railway electrification. Japanese machinery and equipment is being more and more used in the smaller power houses. But where efficiency is the first requisite and for large installations, foreign equipment is steadily increasing, in popularity, and volume of sales.

The total generating capacity of all Japanese power houses completed and under construction, increased 288,597 kilowatts during the year. The next table shows the uses of the power generated.

	Light and Power Supply kilowatts	Railways kilowatts	Railways & Supply kilowatts	Total kilowatts
December 31, 1922	1,393,099	6,995	597,342	1,997,436

The greatest increase during the year was in the generating capacity of power houses for companies engaged in power and light supply and operating railways.

The normal generating capacity of all Japanese power plants, erected and in operation, and in course of erection is given in the following table:—

End December, 1922.

	Electric Supply Hydro Kw.	Electric Supply Steam Kw.	Electric Railways Hydro Kw.	Electric Railways Steam Kw.
Completed	556,062	112,351	615	600
Under construction ...	710,036	14,650	1,480	4,300
Total	1,266,098	127,001	2,098	4,900

	Supply and Railways Hydro Kw.	Supply and Railways Steam Kw.	Total Hydro Kw.	Total Steam Kw.
Completed	295,859	144,264	852,536	257,215
Under construction ...	140,319	16,900	851,835	35,850
Total	436,178	161,164	1,704,371	293,065

Power plants to be completed during 1923 will bring the generating capacity of the Japanese power houses up to more than 2,250,000 kilowatts.

Ujigawa Electric Company.—The Ujigawa Electric Company has closed a contract with Seimens for two 10,000 KVA water-wheel generators. These will be driven by J. M. Voith water turbines. This plant will operate in parallel with their new 50,000 KVA plant, which installation is rapidly progressing (the last issue of THE FAR EASTERN REVIEW shows a picture of the spindle used). Generators were the largest physically ever brought into Japan. They are not of high speed but are the largest in size.

Osaka Railway Company.—Formerly steam road. This company has purchased 13 cars, each equipped with 100 h.p. narrow gauge motors. They are operating over about half the line, half being electrified.

Electrification of Steam Railways During 1922

The Japanese government departments carried on a strong propaganda for the electrification of steam railways in 1921, and as a result there were 33 new companies licensed in 1922 to construct electric railways, the total length of the lines to be built amounting to 436 miles. Nineteen of these companies have begun construction on 83 miles.

The old companies were not slow to adopt the government's suggestions and eight of them applied for licenses to electrify their lines, at the same time several companies licensed to construct steam railways but not yet started on construction, applied for new licenses to build electric lines. The following table shows the companies which electrified their lines during 1922:—

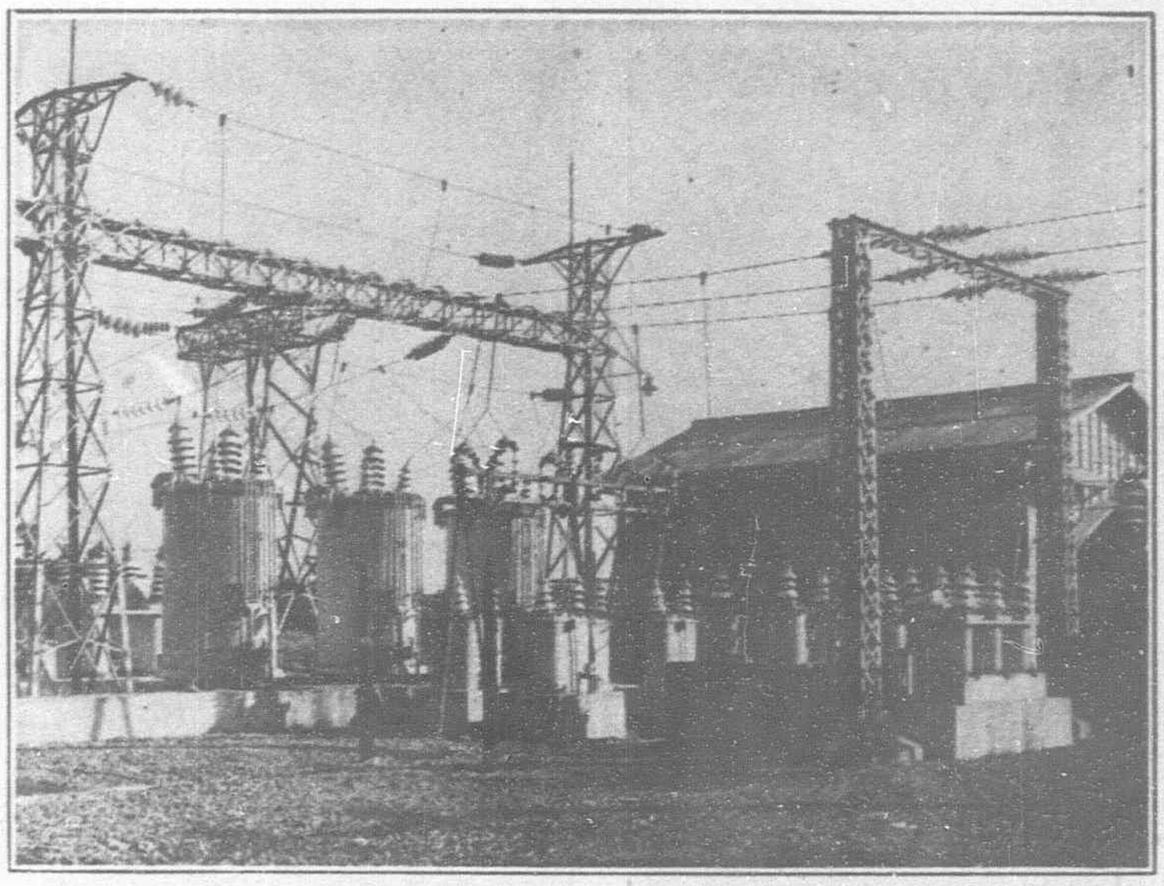
Name	Terminals	Distance between terminals.
Chichibu Ry. Co. ..	Haniu-Kumagai	9.3 miles
Musashino Ry. Co. ..	Ikebukuro-Tokorozawa	15.5 „
Chichibu Ry. Co. ..	Kagemori-Arakawa	1.4 „
Nishio Ry. Co. ..	Shinichinomiya-Tsushima	16.4 „
Osaka Denki ..	Hirahana-Tenri	
Joshin Denki ..	Takasaki-Shimonita	
Ihigawa Denki ..	Ihi-Kuwana	
Yoshino Ry. Co. ..	Yoshinoguchi-Yoshino	
Echigo Ry. Co. ..	Nishi Yoshida, Uhiko-Tsubame	6.5 „
Total mileage		115.9 miles

The following steam railway companies which had obtained licenses to start construction were re-licensed to build electric lines :—

Names	Terminals	Distance between terminals.
Nunobiki Ry. Co. ..	Komuro-Michizuki	9.6 miles
Onomichi Keiben Ry. Co. ..	Nishi Onomichi-Ichi	10.3 ,,
Shizuoka Denki ..	Katahai-Iriemachi	13.1 ,,
Echigo Ry. Co. ..	Tsubame-Ichikido	4.3 ,,
Yoshino Ry. Co. ..	Yoshinoguchi-Unebi	8.0 ,,
	Total mileage	45.6 miles

The following lines were licensed to begin construction :—

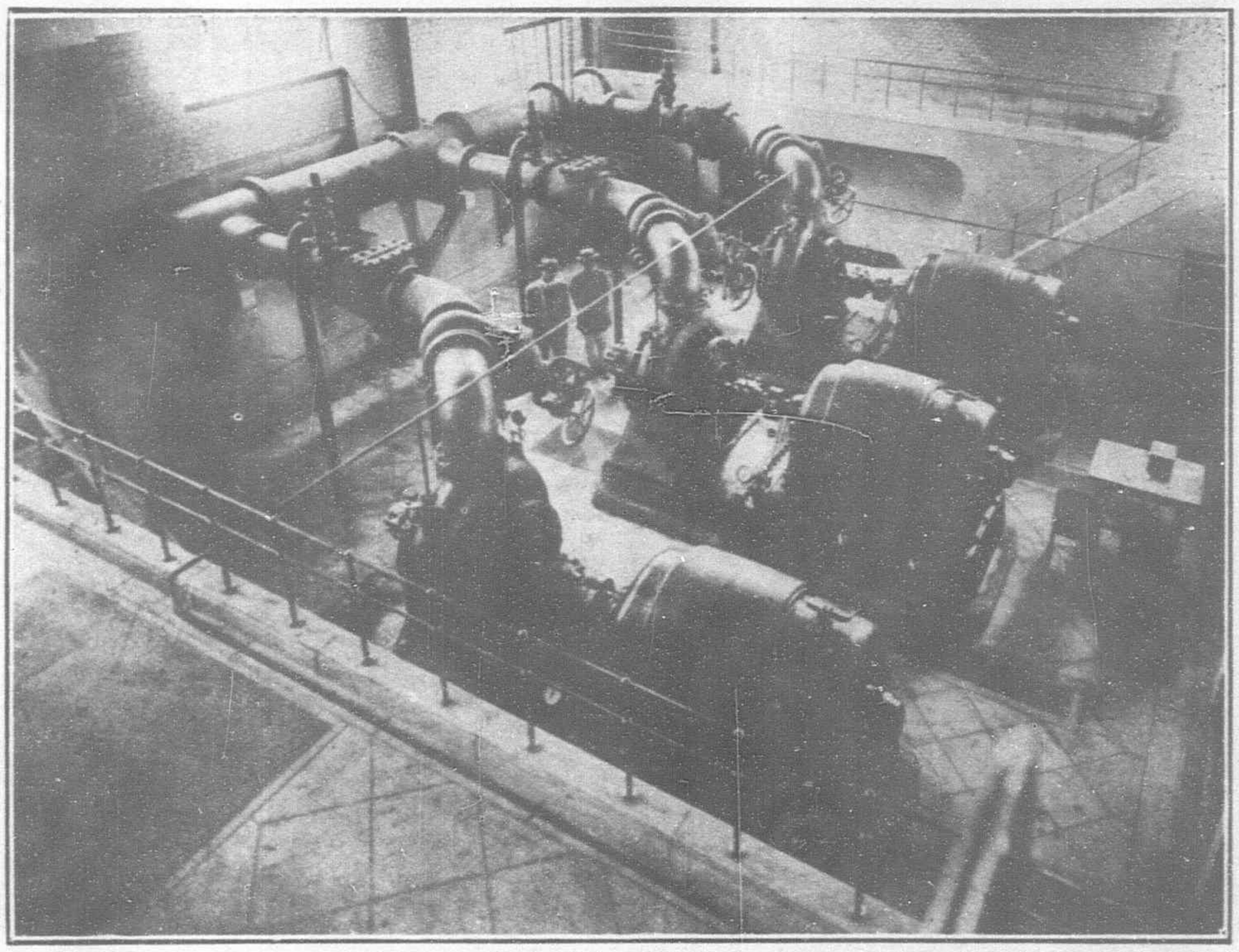
Daiyuzan, Odawara-machi-Minami Ashigara-mura ..	5.4 miles
Onishi, Ichinomiya-machi-Nakamura	10.0 ,,
Morioka Denki Kogyo K.K., Hanamakicho, Yumoto-mura	5.5 ,,
	21.2 miles
Grand total	185.0 miles



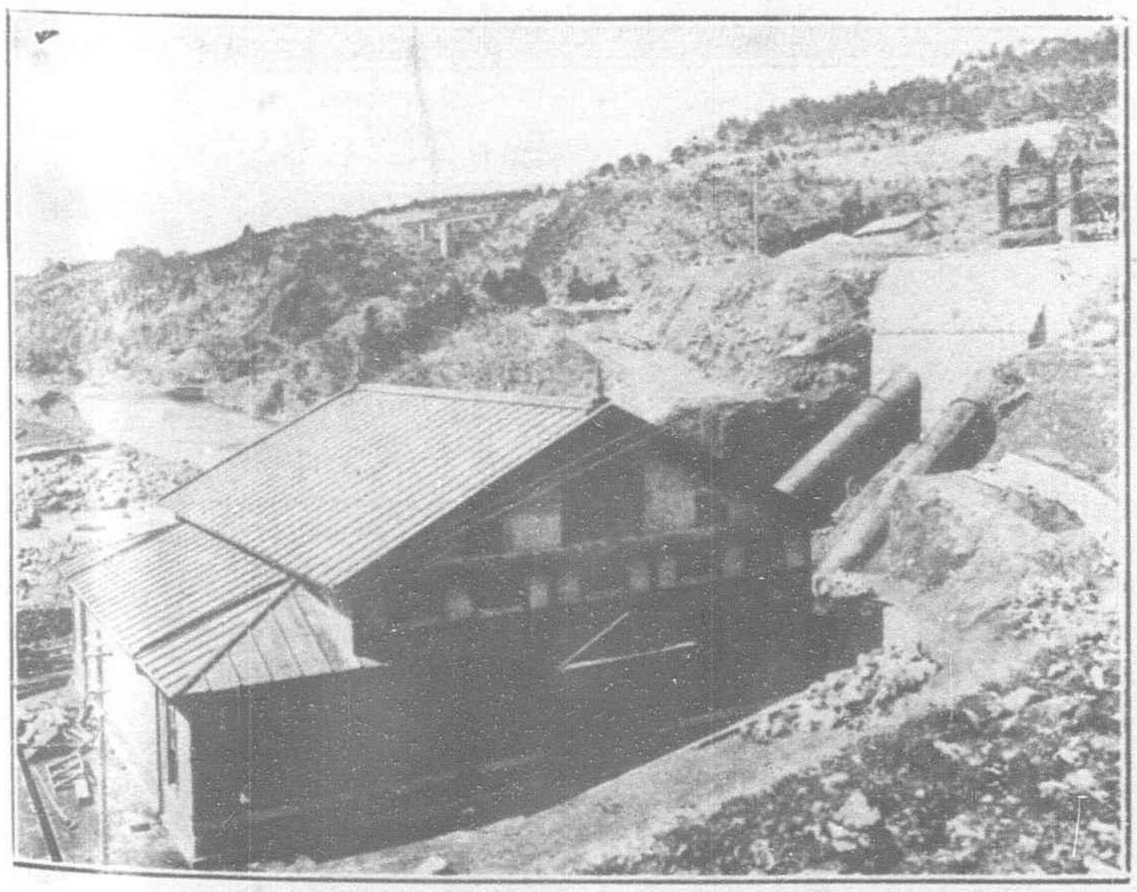
Outside Izumo Transformer Station of the Toho Denryoku Company, Installed by the Hidachi Engineering Works

American Equipment for Japanese Interurban Electric Line in Kyushu

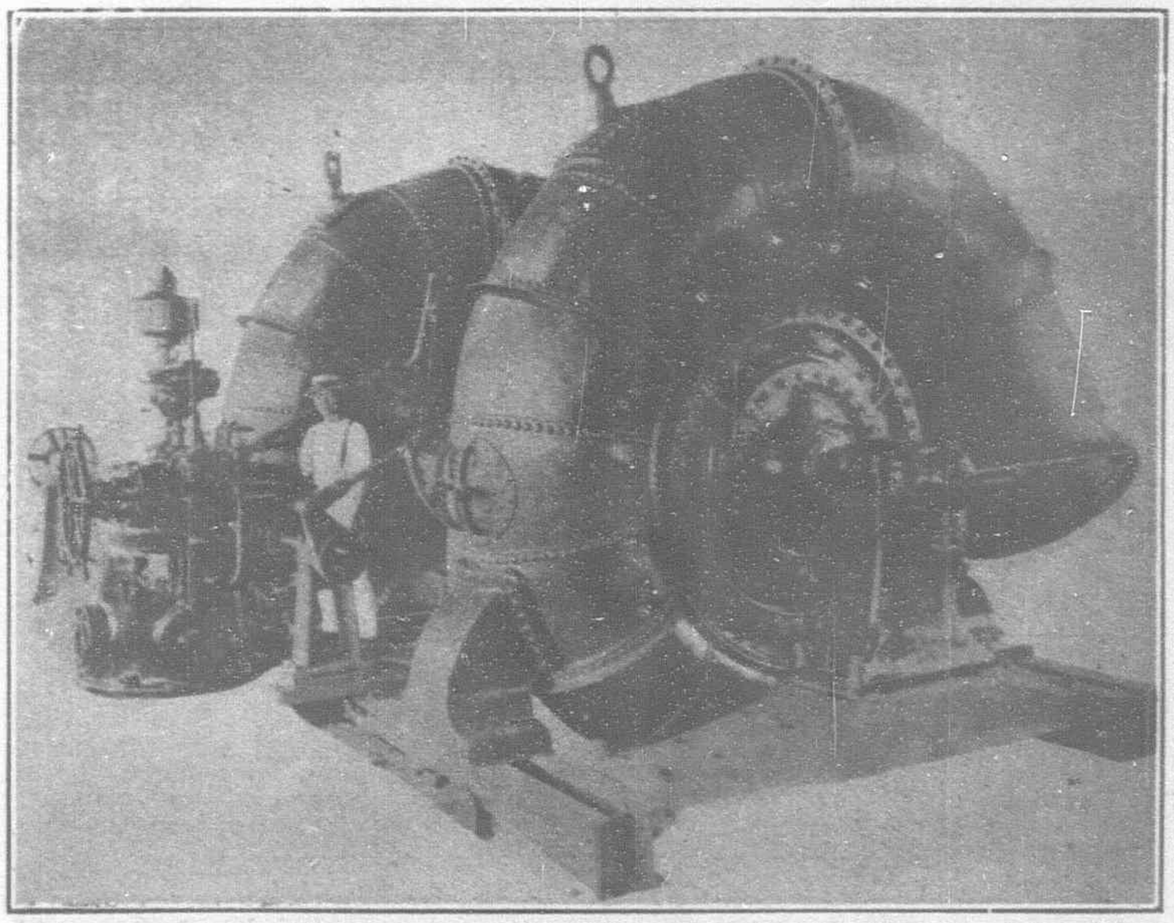
During the month of February the Kyushu Tetsudo, a subsidiary of the Toho Denryoku, purchased car equipments for a new high-speed interurban line running from Hakuta to Kurumi. All of this equipment will be for 1,500 volts D.C. and consists of 18 passenger cars each equipped with 4 65 h.p. field control, Westinghouse motors, with full automatic multiple switch control. Also 4 package cars, each equipped with 4 65 h.p. Westinghouse motors with full automatic control. This installation is of special importance as it is the first high-speed interurban line in Kyushu, and in view of the fact that 1,500 volts have been adopted this voltage no doubt will be the standard for future interurban lines in that island.



Pumping Station of the Osaka Municipal Waterworks. Installed by the Hidachi Engineering Works. 14-in. Single Stage Turbine Pumps, 200-ft. Head, 450 c.m. per min., 1,170 r.p.m., 285 h.p.

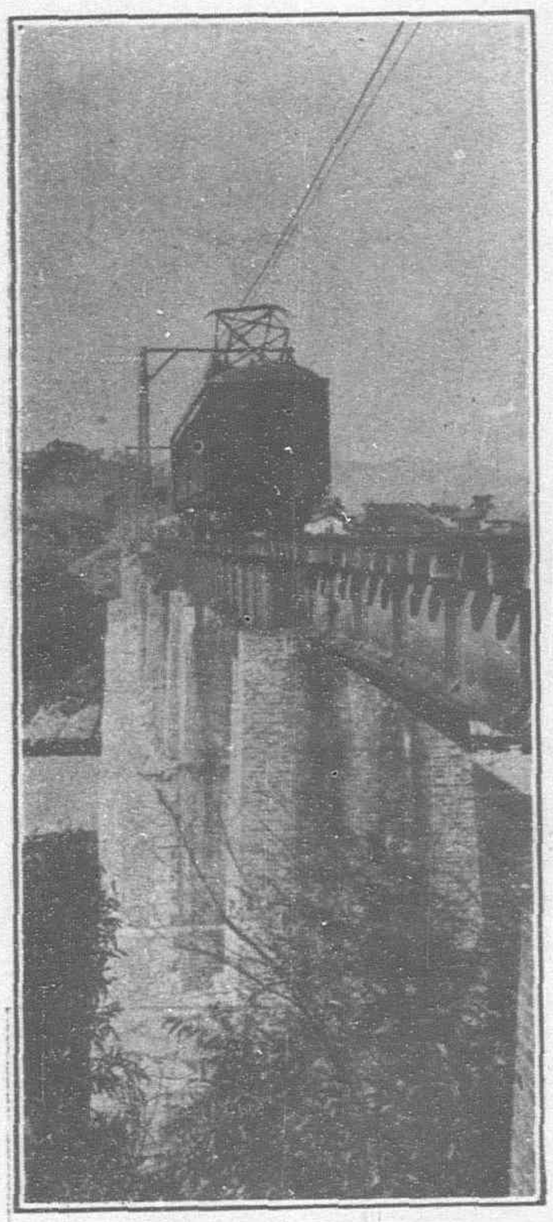


Power House

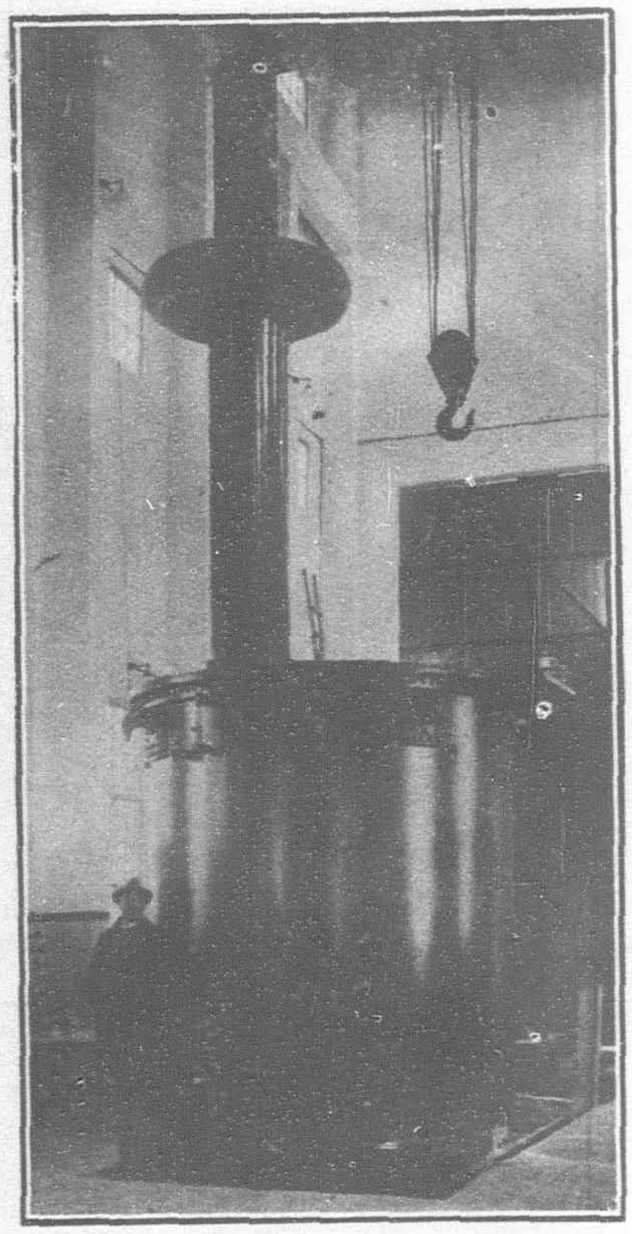


Twin Spiral Turbine, 1,950 H.P., driving 250 K.V.A. Generator, 7,000 v., 60 cycles, 257 r.p.m. Exciter 20 k.w., 125 v.

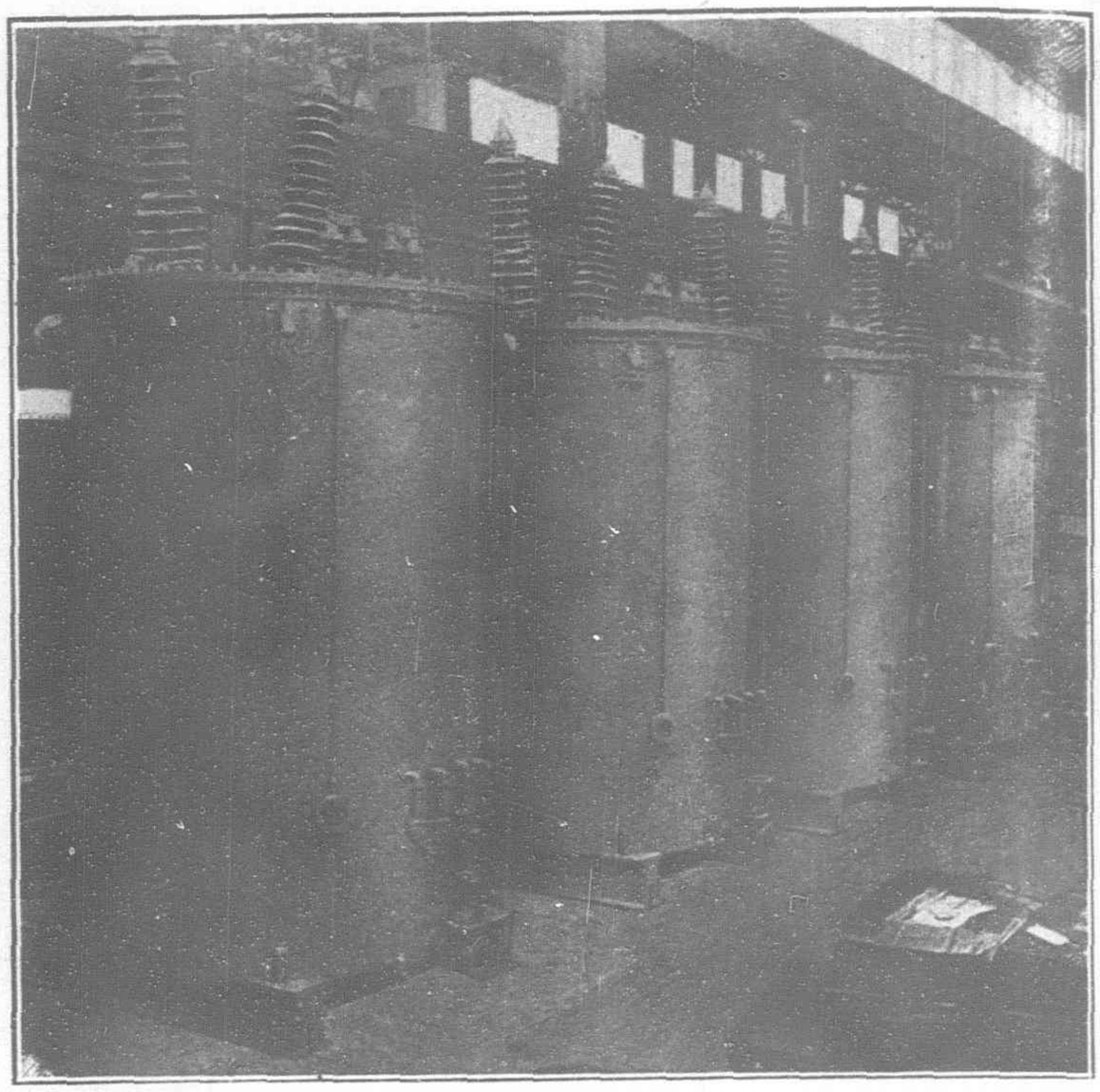
KUROKAWA No. 3 POWER PLANT OF THE KUMAMOTO ELECTRIC COMPANY INSTALLED BY THE HIDACHI ENGINEERING WORKS



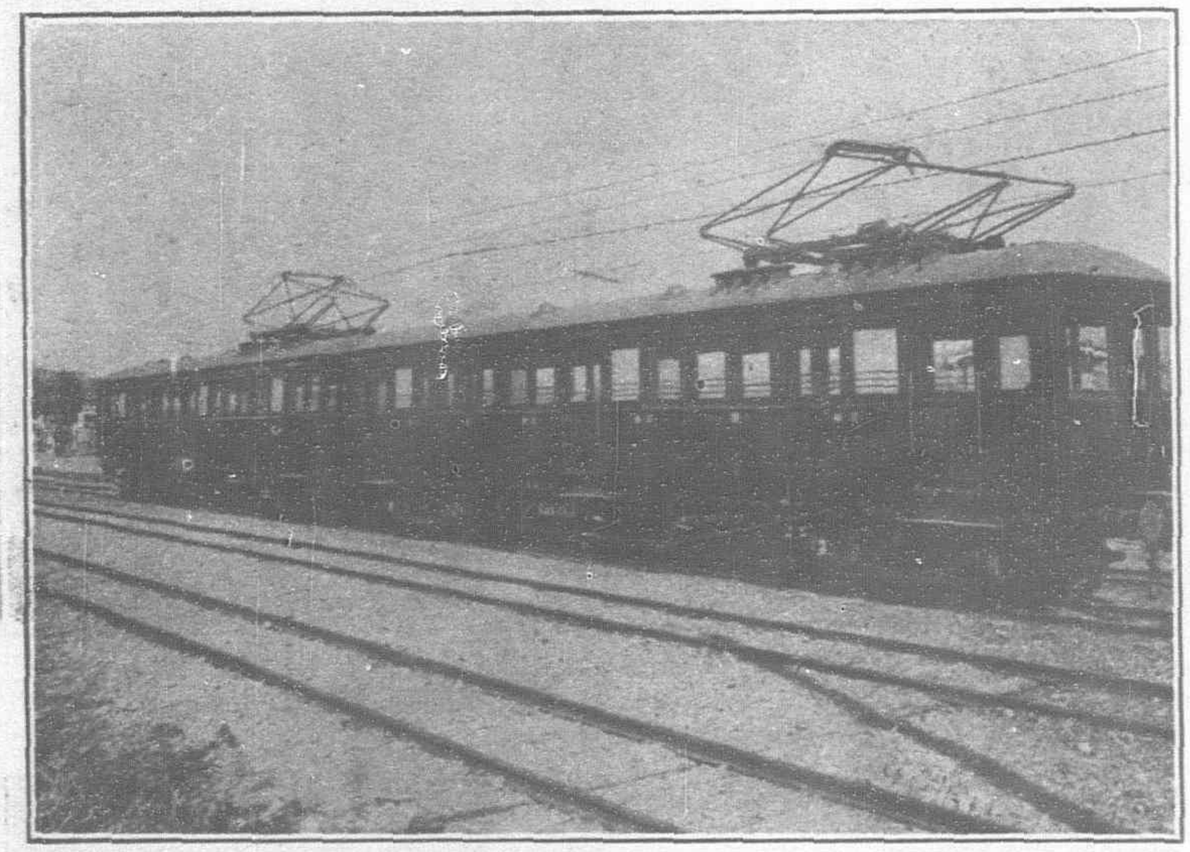
A Bridge on the Electrified Line ot the Kyushu Railway Company

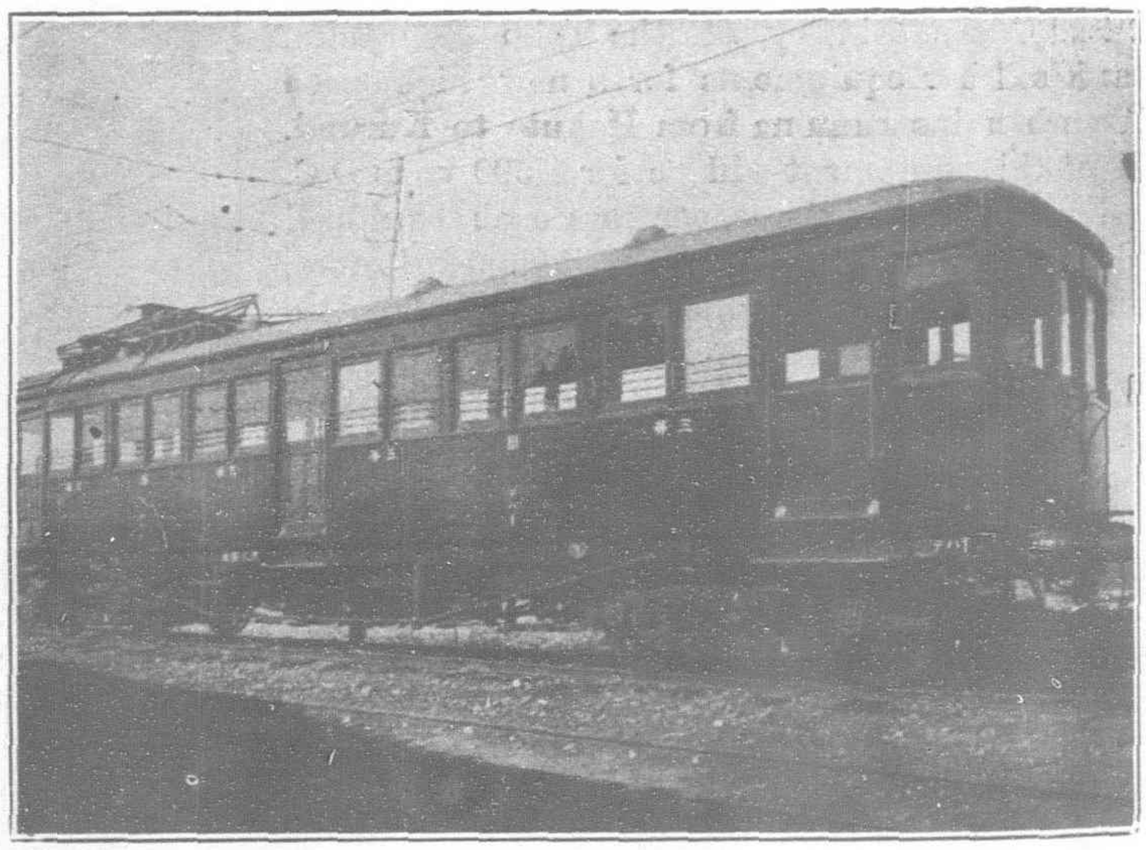


500,000 volt Westinghouse Transformer for the Tokyo Electric Company. Only two in Japan: One at Kameido, other at Nihon Denryoku K.K. Osaka

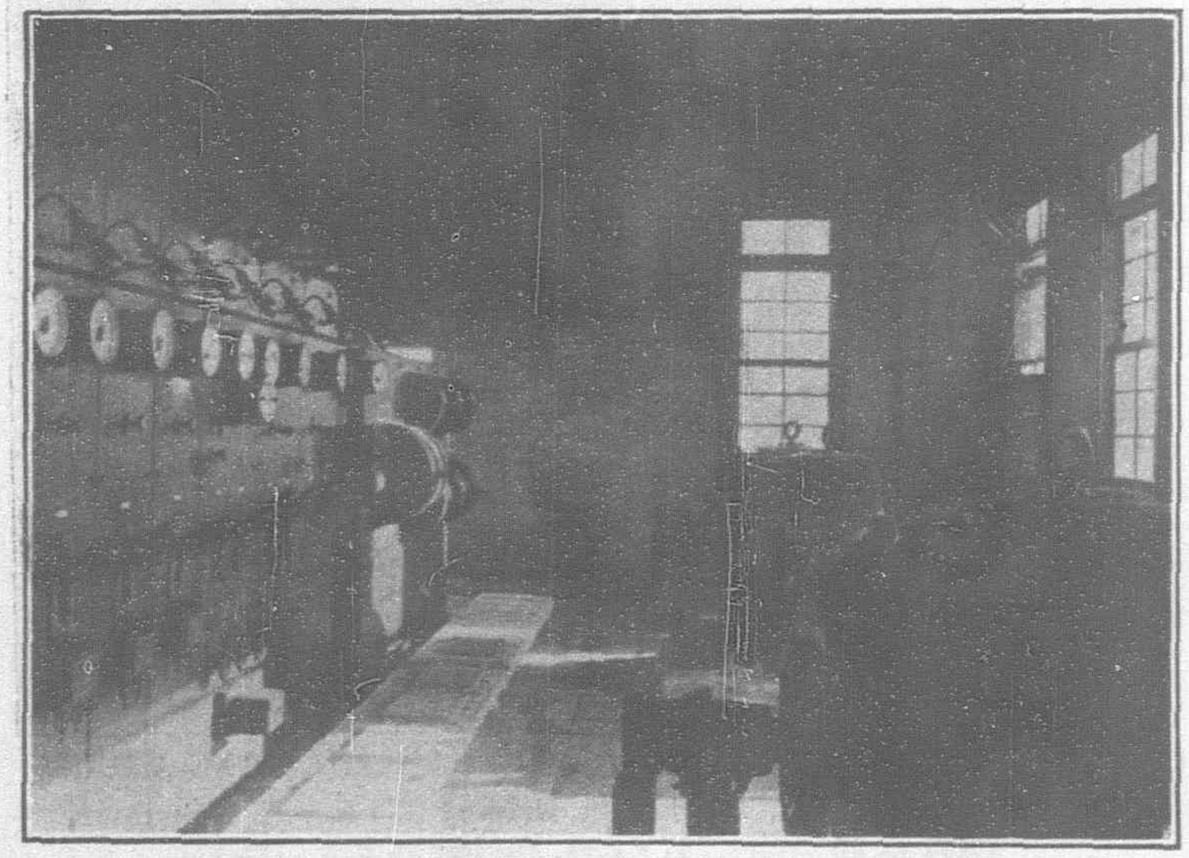


The largest transformers in the world made by the Westinghouse Electric Company are on their way to Japan. 4 each of 21,000 KVA capacity, oil insulated, water cooled, single-phase transformers, voltages of 154,000 to 66,000. They will be installed at the Komatsuo substation of the Tokyo Electric Light Company. There are installed at Pittsburgh, Pa., 4 transformers of larger KVA capacity but of less weight and size; as the Tokyo Electric transformers are for such high voltage that their size is materially increased

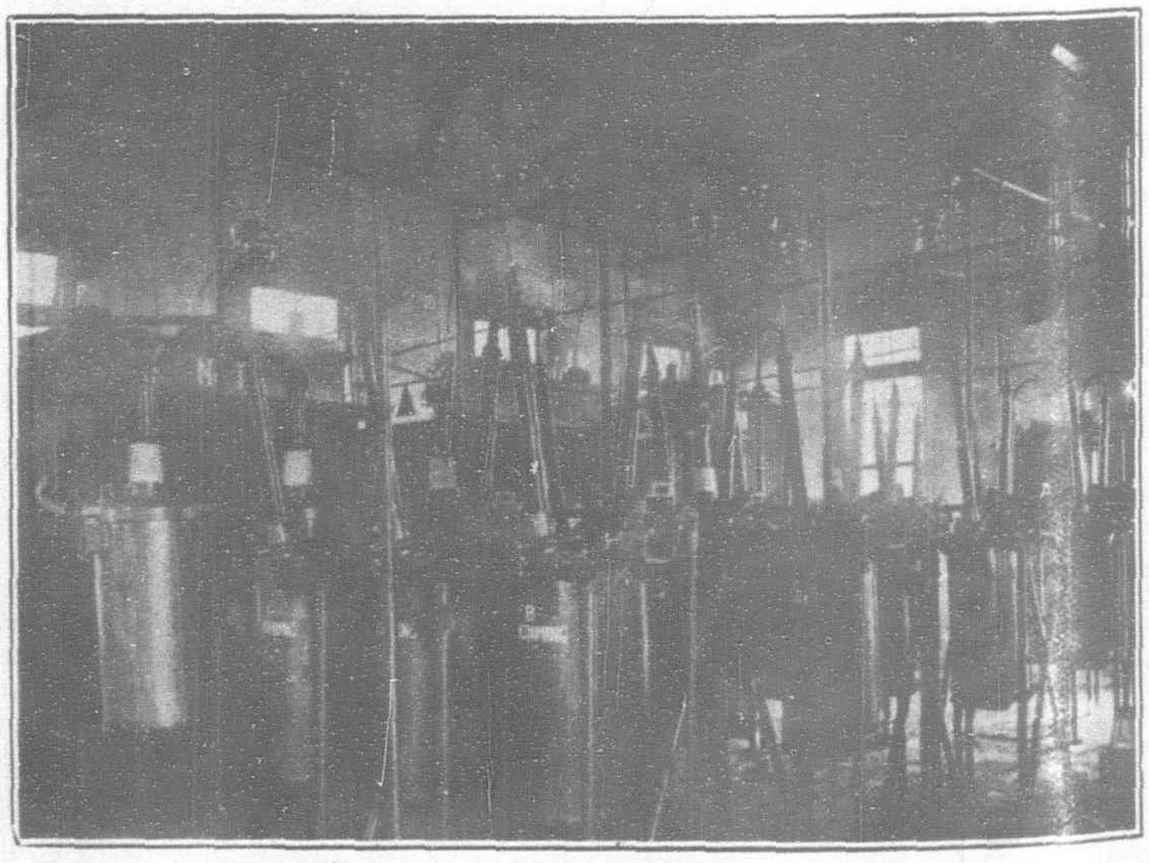




Typical High Speed Interurban Cars



Showing D.C. Generators and A.C. and D.C. Switchboards



Transformer and Oil Switch Room

POWER PLANTS COMPLETED IN 1922

This list is compiled from the records of the Imperial Japanese Department of Communications

Prefecture in which company is located.	*Owner.*	*Exact Location of Power Plant*	*Power Deried From*	*Capacity of Plant Kilowatts*
Aichi	Kansai Denki K.K.	Nakajo Mura, Minami Setsura Gun	Kankyo River	800
	Bisan Denryoku K.K.	Asahi Mura, Higashi Kamo Gun	Funato River	1,100
			Neha River	2,500
Akita	Amigawa Denryoku K.K.	Arase Mura, Kita Akita Gun	Ozawa Diver	55
	Yoneshirogawa Suiden K.K.	Miyagawa Mura, Shikazune Gun	Yoneshiro River	800
	Tohoku Kogyo K.K.	Ikuho Uchi Mura, Senhoku Gun	Hataya River	23
Aomori	Ikarigaseki Denki K.K.	Ikarigaseki Mura, Minami Tsugaru Gun	Fudo River	32
Chiba	Chiba Suiden K.K.	Matsuoka Mura, Aiko Gun	Kohitsu River	87
Ehime	Iyo Tetsudo Denki K.K.	Yanagiwa Mura, Kami Ukiana Gun	Kuro River	3,750
	Nakajima Denki K.K.	Higashi Nakajima Mura Onsen Gun	Gas	37
	Ayukaeri Denki K.K.	Tanisuji Mura, Higashi Uwa Gun	Inau River	30
Fukui	Nanetsu Denki K.K.	Nishi Yasui Mura, Tanjo Gun	Ikko River	124
Fukuoka	Mikasa Village	Mikasa Mura, Tsukushi Gun	Homan River	23
	Kyushu Suiryoku Denki K.K.	Minami Yamada Mura, Kushu Gun	Naruko River	3,550
Fukushima	Hiegi Suiryoku Denki K.K.	Hiegi Mura, Minami Aizu Gun	Hiegi River	3
	Kurotani Gawa Suiryoku Denki K.K.	Asahi Mura, Minami Aizu Gun	Kurotani River	50
Gifu	Azuma Shirakawa Village	Higashi Shirakawa Mura, Kamo Gun	Shirakawa River	50
	Daido Denryoku K.K.	Okuwa Mura, Nishi Chikuma Gun	Sai River	562
	Kaminoho Denki K.K.	Kaminoho Mura, Bugi Gun	Tsuho River	15
	Miura, Kenjiro	Kami Gogo Mura, Kaji Gun	Takenokura River	6
	,,	Yenokyo Mura, Ako Gun	,,	6
	Nohi Denki K.K.	One Mura, Motosu Gun	Nokyodani River	140
	Sodegawa Dento K.K.	Sodegawa Mura, Kichijo Gun	Oda River	54
	Tajimi Dento Sho	Sue Mura, Ena Gun	Ozato River	180
	Toki Suiryoku Denki K.K.	Toki Mura, Yoro Gun	Toriya River	170
	Tomino Suiryoku Denki K.K.	Tomino Mura, Bugi Gun	Kiso River	9,200
	Toyama Village	Toyama Mura, Motosu Gun	Kanahara River	17
	Yasaku Suiryoku Denki K.K.	Inari Mura, Kita Setsura Gun	Tsuho River	20
	Yoshidagawa Suiryoku Denki K.K.	Oku Akegata Mura, Gunjo Gun	Yoshida River	19
Gunma	Miharada Denki K.K.	Yokonomura, Seta Gun	Kurosawa River	29
	Tokyo Dento K.K.	Naganohara Machi, Azuma Gun	Kuma River	2,339
	Izumigawa Suiden K.K.	Otomura, Azuma Gun	Izumizawa River	41
	Takayama Suiden K.K.	Nakayama, Takayama Mura, Azuma Gun	Kuma River	30
	Kanagawa Village	Kamikawa Mura, Tano Gun	Funako River	45
Hokkaido	Hokkaido Godo Denki K.K.	Rumoe Machi, Rumoe Gun	Steam	200
	Hokkaido Dento K.K.	Hobetsu Mura, Akan Gun, Kushiro Province	Hobetsu River	2,200
	Hakodate Suiden K.K.	Ono Mura, Kameda Gun, Watarishima Province	Ono River	900
Hyogo	Shinoyama Dento K.K.	Miken Mura, Taki Gun	Gas	90
	Chitane Suiryoku Denki K.K.	Chitane Mura, Shishiguri Gun	Kurotsuchi River	7
	Sakagami Kyoko Dentetsu K.K.	Imazu Mura, Buko Gun	Steam	10,000
Ibaragi	Ibaragi Denryoku K.K.	Takahara, Tagano Satomae Mura	Kawashiri River	156
	Kurosawa Dento K.K.	Kurosawa Mura, Kuji Gun	Hachimizo River	12
	Hanazawa Denki Kido K.K.	Saigawa Mura, Ishikawa Gun	Steam	24
Kagawa	Seisan Denki K.K.	Kami Takase Mura, Santoyo Gun	Gas	50
Kagoshima	Toki Denki K.K.	Higashi Shuzan Mura, Gora Gun	Nishino River	256
	Banrai Suiryoku Denki K.K.	Kawabe Mura, Kawabe Gun	Banrai River	500
	Takakuma Denki K.K.	Takakuma Mura, Kimozoku Gun	Takakuma River	320
Kanagawa	Sobu Denryoku K.K.	Aikawa Mura, Aiko Gun	Nakatsu River	440
Kochi	Tosa Tobu Denki K.K.	Kiragawa Mura, Aki Gun	Kirishima River	550
	Yasuki Suiryoku Denki K.K.	Umamichi Mura, Aki Gun	Kushu River	1,574
Kumamoto	Mamihara Suiryoku Denki K.K.	Kanbi Mura, Aso Gun	Gokase River	68
	Kumamoto Denki K.K.	Seta Mura, Kikushi Gun	Kurokawa River	2,000
Kyoto	Yakuno Suiden Kumiai	Kamiyakuno Mura, Amada Gun	Asahi River	3,200
	Keishin Denki Kido Fune Kaisha	Katsuragawa Mura, Shiga Gun, Shiga Prefecture	Andon River	880
Mie	Tsu Dento K.K.	Taneoi Mura, Taka Gun	Kawakami River	400
	Ise Denki Tetsudo K.K.	Miyamae Mura, Iinan Gun	Kushida River	832
	Mie Godo Denki K.K.	Chihiroe Mura, Iinan Gun	Kushida River	700
	Toshi Denki K.K.	Ohata, Toshi Mura, Shizun Gun	Gas	8
Miyagi	Eai Suiden K.K.	Ichikuri Mura, Tamamichi Gun	Ihaya River	3,000
	Saikawa Denki K.K.	Fukuoka Mura, Karita Gun	Tarekiyo River	75
	Hatorigawa Suiryoku Denki K.K.	Moniwa, Umarede Mura, Natori Gun	Hatori River	470
Miyazaki	Minami Naka District	Kita Hikugo Mura, Minami Waka Gun	Hiroto River	240
Nagano	Ohinata Dento K.K.	Ohinata Mura, Minami Saku Gun	Nukii River	29
	Miho Village	Miho Mura, Shimo Ina Gun	Achi River	35
	Wada Suiryoku Denki K.K.	Wadamura, Shimo Ina Gun	Ikeguchi River	48
	Suwa Denki K.K.	Wada Mura, Chiusagata Gun	Wada River	886
Nagasaki	Hayaki Village	Hayaki Mura, Nishi Kubiki Gun	Gas	25
	Tsushima Dento K.K.	Keichi Mura, Shimo Agata Gun	Gas	20
Nara	Shinki Ikoma Denki Tetsudo K.K.	Heigun Mura, Ikoma Gun	Steam	300
	Ujigawa Denki K.K.	Kami Kitayama Mura, Yoshino Gun	Shira River	1,500
Niigata	Murakami Suiden K.K.	Kurokawa Mura, Kanbara Gun	Taiani River	610
	Kubiki Denki K.K.	Kushiike Mura, Nakakubiki Gun	Kiyotaki River	44
	Sarikawa Suiryoku Denki K.K.	Yunotani Mura, Kita Uomuma Gun	Sari River	160
	Yoneyama Suiden K.K.	Kami Yoneyama Mura, Nakakubiki Gun	Yone River	11
Oita	Kamiida Suiryoku Denki K.K.	Kami Ida Mura, Ono Gun	Dakufuchi River	50
	Kugimiya Suiden K.K.	Imbi Mura, Minami Umbe Gun	Imbi River	175
Okayama	Chugoku Suiryoku Denki K.K.	Hisada Mura, Tomada Gun	Yoshii River	6,000
	Mimasaku Denki K.K.	Hayashino Machi, Eita Gun	Gas	65
	Chugoku Suiryoku Denki K.K.	Katsuyama Machi, Maniwa Gun	Naka River	1,200
Osaka	Ujigawa Denki K.K.	Nakaso Mura, Nakano Gun	Yoshino River	1,661
	Daido Denryoku K.K.	Johoku Mura, Tosei Gun	Steam	12,500
	Osaka Dento K.K.	Nishino Shimono Machi, Nishi Ku, Osaka City	Steam	20,000
Saga	Tamajima Suiden K.K.	Tamajima Mura, Higashi Matsuura Gun	Ogawa River	17
	Toho Denryoku K.K. (Kyushu Office)	Nanzan Mura, Koshiro Gun	Kawakami River	1,150
Saitama	Naguri Suiden K.K.	Naguri Mura, Iruma Gun	Arima River	217
Shiga	Ujigawa Denki K.K.	Higashi Kokyo Mura, Aichi Gun	Miike River	750
Shimane	Chogo Denki K.K.	Togo Mura, Shukichi Gun	Gas	20
	Torimae Denki K.K.	Kuroki Mura, Chifu Gun	Gas	20
Shizuoka	Asahina Suiryoku Denki K.K.	Asahina Mura, Shita Gun	Asahina River	10
	Fuji Suiden K.K.	Ueno Mura, Fuji Gun	Shiba River	1,070

Tochigi	Utsunomiya Branch of the Teikoku Dento K.K.	Funao Mura, Enya Gun	Kinugawa River	1,592
Tokushima	Nanishi Suiryoku Denki K.K.	Shinryo Mura, Nanishi Gun	Noma River	130
	Tokushima Suiryoku Denki K.K.	Miyahama Mura, Naka Gun	None River	85
	Umbe Suiryoku Denki K.K.	Anakui Mura, Kaiso Gun	Asahide River	25
	Hiychinada Denki K.K.	Minamura, Miyoshi Gun	Shirakawa River	275
Tokyo	Tokyo Dento K.K.	Mitomi Mura, Yamanashi Gun, Yamanashi Prefecture	Fuefuki River	3,000
Toyama	Nakakoshi Suiden K.K.	Oyama Mura, Une Arakawa Gun	Kumano River	320
	Toyama Denki K.K.	Katakai Mura, Shin Shinkawa Gun, two plants	Katakai River	2,550 3,700
	Jintsugawa Denki K.K.	Miyagawa Mura, Fuoi Gun, two plants	Jintsu River	1,000 1,200
Wakayama	Nankai Suiryoku Denki K.K.	Iwakura Mura, Arita Gun	Arita River	500
	Baibaisan Kumiai Kankitsu, of Nishikawara	Kawahara Mura, Naka Gun	Nata River	15
Yamagata	Tsuruoka Suiryoku Denki K.K.	Hongo Mura, Higashi Tagawa Gun	Otori River	1,000
Yamanashi	Katsura Dento K.K.	Higashi Katsura Mura, Minami Toru Gun	Natsukari Canal	190
				128,824

Water Power ... 85,465 k.w. Steam ... 43,024 k.w. Gas ... ... 335 k.w. Total capacity of all plants erected in 1922.

Prefecture in which company is located	*Owner of Enterprise*	*Object of Business*	*Location of Districts of Supply Railway Line*	*Kind of Power*	*Capacity of Plant* Kilowatts	*Capital* Yen.
Aichi	Kaiki Dento K.K.	Light & Power Supply	Asahimura, Higashi Kamo Gun, and 1 other village	Receives power	20	65,000
	Onishi Tetsudo K.K.	Railway	Shin Ichinomiya to Port Kisogawa Station	,,	300	737,204
	Bisan Denki K.K.	Light & Power Supply	Asuri Mura, Higashi Kamo Gun and one more village	Water from Funato River	1,100	5,000,000
Akita	Amigawa Denryoku K.K.	,,	Animura, Kita Akita Gun, 4 towns and villages	Water from Ozawa River	55	250,000
Aomori	Okuirise Dento K.K.	,,	Hookuzawa Mura, Kawakita Gun	Receives power	15	50,000
Chiba	Chiba Suiden K.K.	,,	Kururi Machi, Kimitsu Gun, and 10 other villages	Water from Kohitsu River	87	300,000
Ehime	Oda Suiryoku Denki K.K.	,,	Oda Machi Mura, Ukiana Gun, and one other village	Receives power	10	50,000
	Ayukaeri Denki K.K.	,,	Tasuji Mura, Higashi Uwa Gun	Water from Inau River	30	70,000
Fukui	Hinogawa Suiryoku Denki K.K.	,,	Ojihomura, Nanjo Gun and 8 other villages	Receives power	75	200,000
Fukuoka	Mikasa Village	,,	Mikasa Village, Tsukushi Gun	Water from Homan River	23	22,400
Fukushima	Hiegi Suiryoku Denki K.K.	,,	Hiegi Mura, Minami Aizu Gun	Water from Hiegi River	3	20,000
	Kurotanigawa Suiryoku Denki K.K.	,,	Asahi Mura, M;inami Aizu Gun, and 4 other villages	Water from Kurotani River	50	100,000
Gifu	Yoshidagawa Suiryoku Denki K.K.	,,	Oku Akegata Mura, Gunjo Gun	Water from Yoshida River	19	75,000
	Toyama Village	,,	Toyama Mura, Motosu Gun	Water from Kanahara River	17	150,000
	Miura, Kenjiro	,,	Chonan Mura, Kamo Gun, and one other village	Water from Takenokura River	6	110,000
	Shizunami Village	Light only	Shizunami Mura, Ena Gun and one other village	Receives power	10	28,720
	Nohi Denki K.K.	Light & Power	One Mura, Motosu Gun, and 15 other villages	Water from Nokyodani River	140	3,000,000
	Sodegawa Dento K.K.	,,	Sodegawa Mura, Kichijo Gun	Water from Oda River	54	100,000
	Tomino Suiryoku Denki K.K.	,,	Tomino Mura, Bugi Gun	Water from Tsuho River	20	70,000
	Toki Suiryoku Denki K.K.	,,	Toki Mura, Yoro Gun	Water from Toriya River	170	300,000
Gunma	Hara Village	,,	Haramachi, Azuma Gun	Receives	10	89,000
	Izumizawa Suiden K.K.	Light only	Otamura, Azuma Gun	Water from Izumi Zawa River	41	80,000
	Miharada Denki K.K.	Light & Power	Yokonomura, Seta Gun	Water from Kurosawa River	29	62,000
	Takayama Suiden K.K.	,,	Takayama Mura, Azuma Gun	Water from Kuna River	30	30,000
Hyogo	Chitane Suiryoku Denki K.K.	Light only	Chitane Mura, Shishiguri Gun	Water from Kurotsuchi River	7	50,000
	Kamihisa Shimo Village	Light & Power	Kami Hisashimo Mura, Hikami Gun	Water from Shinoyama River	70	66,200
Ibaragi	Kurosawa Dento K.K.	,,	Kurosawa Mura, Kuji Gun	Water from Hachimizo River	12	30,000
	Koinose Denki K.K.	,,	Koinose Mura, Shinji Gun	Water from Koinose River	18	20,000
	Kitaura Denki K.K.	,,	20 villages in Namekata Gun	Receives power	15	530,000
Kagawa	Seisan Denki K.K.	,,	Kami Takase Mura, Santoyo Gun	Gas	50	200,000
Kagoshima	Takakuma Denki K.K.	,,	Higashi Sakurajima Mura, Kimozoku Gun and 8 other villages	Water from Takakuma River	320	500,000
Kochi	Kamiida Suiryoku K.K.	,,	Kami Ida Mura, Ono Gun	Water from Dakubuchi River	50	100,000
Kumamoto	Mamihara Suiryoku Denki K.K.	,,	Mamihara Machi, Aso Gun, and 3 villages	Water from Gokase River	68	200,000
Kyoto	Yakuno Suiden Kumiai K.K.	,,	Kami Yakuno Mura, Amada Gun and 2 other villages	Water from Hataya River	23	100,000
Mie	Toshi Denki K.K.	,,	Toshimura, Shima Gun	Gas	8	50,000
Miyagi	Eai Suiden K.K.	,,	Ichikuri Mura, Tamaki Gun, and one more village	Water from Ihaya River	3,000	1,000,000
Nagano	Wada Suiryoku Denki K.K.	,,	Wada Mura, Shimo Ina Gun, and 4 other villages	Water from Ikeguchi River	48	100,000
	Nanshin Denki K.K.	,,	Shimojo Mura, Shimo Ina Gun, and 6 other villages	Receives power	150	1,000,000
	Miho Village	,,	Miho Mura, Shimo Ina Gun	Water from Achi River	35	30,000
	Ohinata Dento K.K.	,,	Ohinata Mura, Minami Saku Gun	Water from Nukii River	29	50,000
Nagasaki	Hayaki Village	,,	Hayaki Village, Nishi Kizuki Gun	Gas	25	70,000
	Tsushima Dento K.K.	,,	Keichi Mura, Shimo Agata Gun	Gas	20	40,000
Nara	Shinki Ikoma Denki Tetsudo K.K.	Railway	From Oji Mura, Kita Katsushiro Gun to Kita Ikoma Mura, Ikoma Gun	Steam	300	1,500,000
	Akino Mura	Light & Power	Akino Mura, Yoshino Gun	Receives power	10	30,000
Niigata	Sarigawa Suiryoku Denki K.K.	,,	Yabugama Mura, Kita Uomuma Gun, and one other village	Water from Sari River	160	400,000
	Yoneyama Suiden K.K.	,,	Yoneyama Mura, Naka Kubiki Gun	Water from Yone River	11	50,000
	Kubiki Denki K.K.	,,	Kushiike Mura, Naka Kubiki Gun, and two more villages	Water from Kiyotaki River	44	100,000
Saga	Tamajima Suiden K.K.	,,	Tamajima Mura, Higashi Matsuura Gun	Water from Ogawa River	17	150,000
Saitama	Musashino Tetsudo K.K.	Railway	From Ikebukuro Machi, Kita Toyoshima, to Tokorozawa Machi, Iruma Gun	Receives power	600	2,000,000
Shimane	Torimae Denki K.K.	Light & Power	Kuroki Mura, Chifu Gun	Gas	20	60,000
Shizuoka	Asahina Suiryoku Denki K.K.	,,	Asahina Mura, Shita Gun	Water from Asahina River	10	40,000
Tochigi	Shimotsuke Denki Tetsudo K.K.	Railway	From Imaichi Machi, Toga Gun to Fujiwara Mura, Enya Gun	Receives power	120	1,000,000
Tokushima	Nakajima Denki K.K.	Light & Power	Higashi Nakajima Mura, Onsen Gun, and one other village	Gas	37	50,000
	Umbe Suiryoku Denki K.K.	,,	Mukimachi, Kaiso Gun and 5 other villages	Water from Nozuchi River	85	300,000
Wakayama	Baibaisan Kankitsu Kumiai, Nishi Kawara	Light only	Kawara Mura, Naga Gun	Water from Nate River	15	100,000
Yamanashi	Kyoto Denki K.K.	Light & Power	Nakamaki Mura, Higashi Yamanashi Gun	Receives power	50	50,000

The Most Important Rice Centre in the Philippines

By Kilmer O. Moe

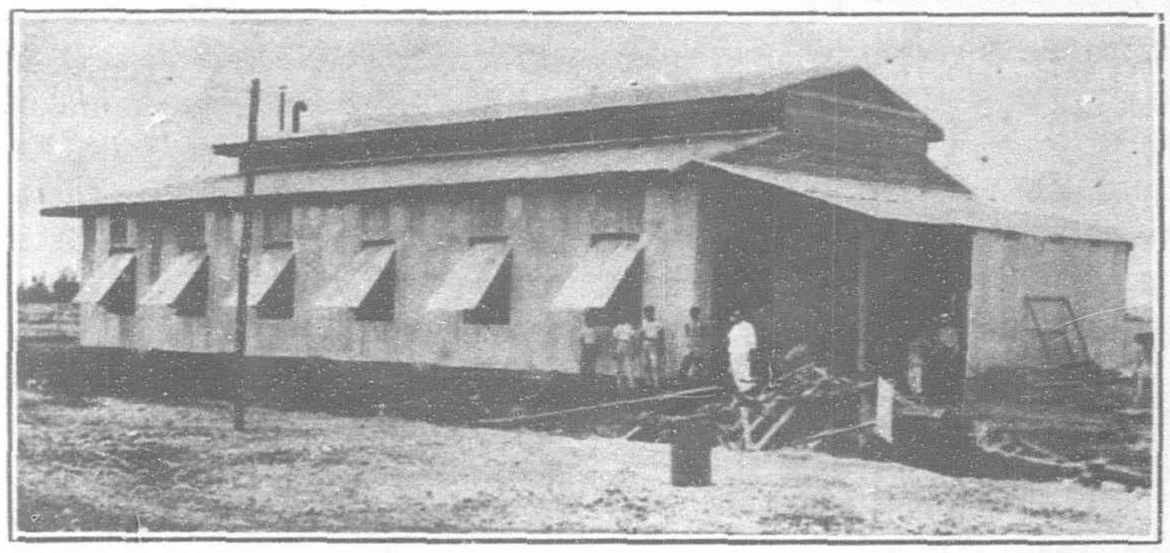
THE railroad ends at Cabanatuan in the province of Nueva Ecija on the Central Luzon plain. Beyond this point the Manila north road, dusty, conjested and travel-scarred, extends on into the homestead country where the settlers have taken up land from the public domain and have converted the wastes of jungle and cogon grass into productive fields.

Talk about bull carts. The road is literally blocked with them. Grinding, jolting and fairly groaning under the heavy loads of paddy rice, they come on in a steady stream. The slow plodding carabao strains at the heavily loaded carts which move in long trains toward market. On the other side of the road a chain of empty carts moves homeward in the opposite direction.

Now and again a lumbering truck comes thundering along raising a cloud of dust. It is loaded down with sacks of paddy to the limits of its capacity. A heavy trailer, equally loaded, is attached to the rear end of the truck and sways from side to side in its efforts to keep up. The dust rains down on the humble bull cart driver and settles thick on his salacot or gourd hat.

The motorist has given this section of the Manila north road a bad name. The conjestion of traffic is anything but pleasant we all admit. It interferes with the speed fiend very decidedly and prevents him from racing along on his way to Baguio where the cool breezes blow and where the famous mountain resort is located. The wheels of the loaded carts, and the ware and tear of the heavy trucks, grind up the road bed to a fine dust which rises in suffocating clouds as the swift moving auto passes through.

The motorist thinks only of the discomforts of the heat, the grime, and the irritation of numerous stops, but loses sight of the real meaning of this procession and what it signifies to the economic growth of the country. These slowly moving trains and the lumbering trucks carry to market the agricultural wealth of a considerable area of Central Luzon. This produce is milled in Cabanatuan and later distributed by rail and boat to distant provinces where it is eagerly received by the hungry masses. The tobacco grower of the Cagayan valley, the sugar baron of Negros, and the hemp and copra producer in the regions of better distributed rainfall, look to the central Luzon plain to supply them with the "Staff of Life." This plain is a vast store house, the granary of the Philippines.

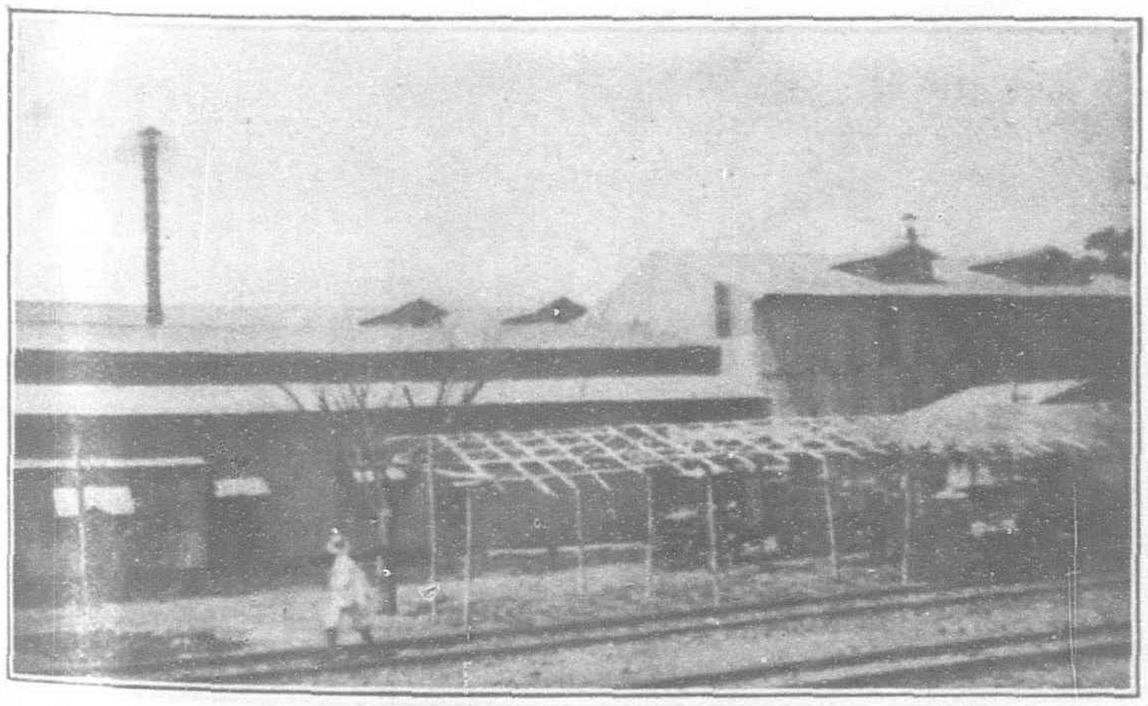


A Simple Unit Rice Mill

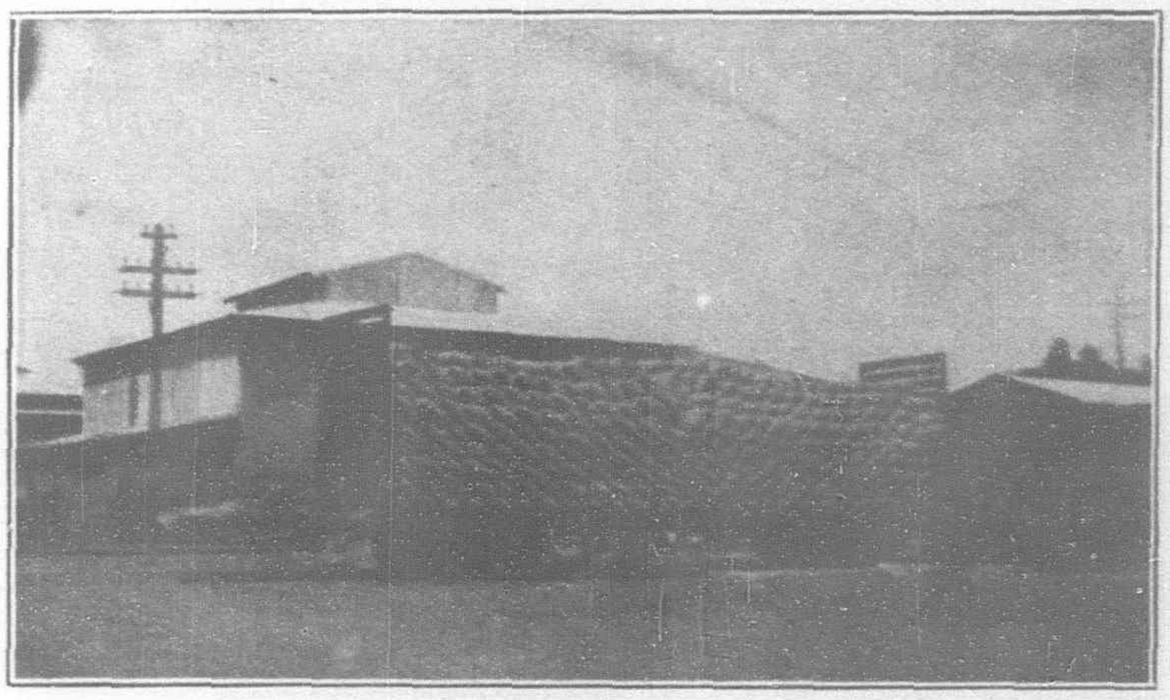
The Loaded Bull Cart

The loaded bull cart is a factor of much greater consequence to the economic welfare of the country than the high priced and dazzling touring car. The humble bull cart piled high with paddy furnishes tangible proof that the hardy pioneer and settler is meeting with a fair degree of success. The homesteader is at last coming into his own. He has succeeded in taming the wild places. The jungles and grasslands finally gave way to cultivated fields. A thousand homes sprang into existence in the old haunts where deer and wild hogs were formerly left in undisturbed possession. The loaded bull cart means that the small farmer is bringing in the fruits of harvest and in depositing his offering is making no small contribution to the growth and well-being of his country.

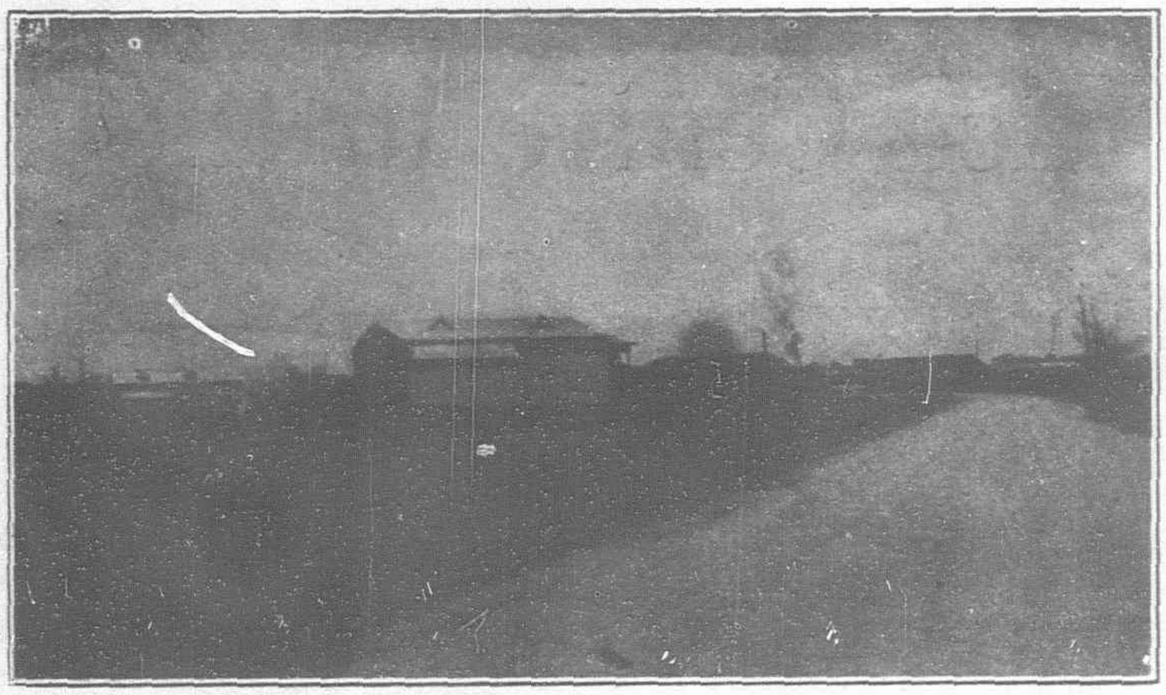
Several million cavans of paddy rice passed over the bridge at Cabanatuan last year representing a value of millions of pesos. These figures take on a greater significance than ever when the fact is taken into consideration that a decade ago the amount was hardly worth mentioning. This annual contribution is a recent development and one which speaks most eloquently for the productive labor of the small farmer. It is another story of hard work and many sacrifices. Years of toil and suffering have been necessary



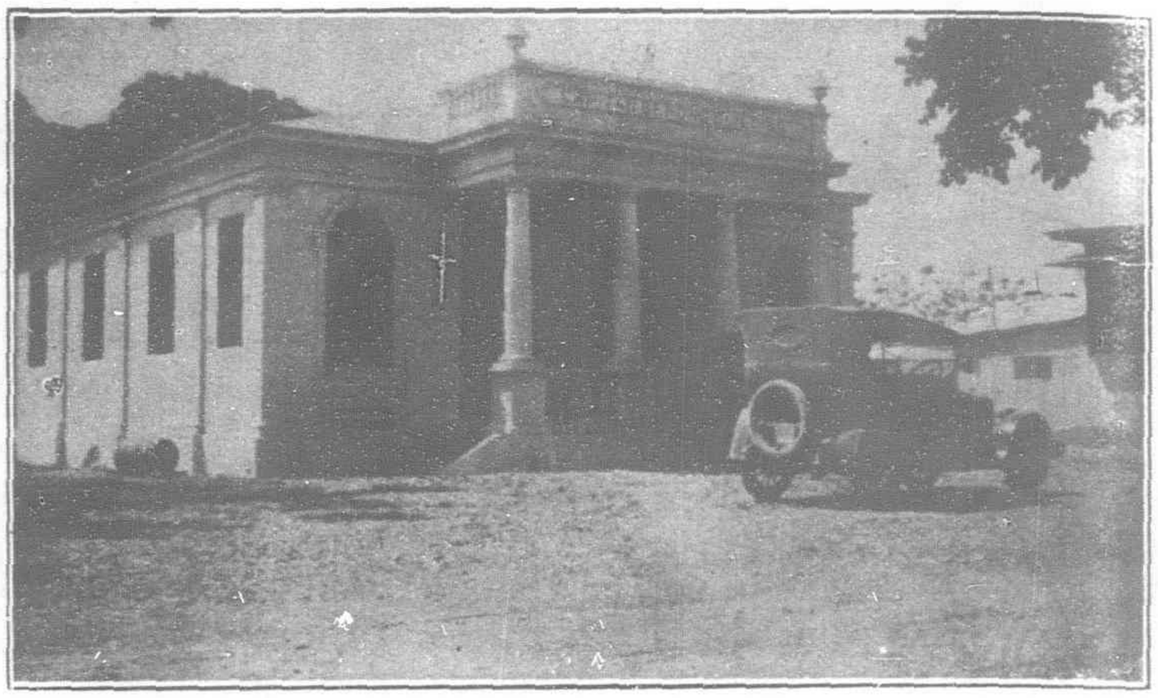
A Multiple Mill That Grew Out of Small Beginning. An Outgrowth of the Single Installation Shown in Above Cut



Ready for Market. The Milled Product is Shipped to Manila



The Town of Cabanatuan Looms up a City of Shed-like Buildings of Corrugated Iron



New Bank Building in Cabanatuan, the most Important Rice Centre in the Philippines

to bring about the present satisfactory condition. Let us follow the train of loaded bull-carts and see what becomes of it.

The Principal Rice Market in the Philippines

Every bull cart driver in the train knows where he is going. If you ask him he will give you a name which is usually Chinese. These astute traders are the middlemen in the Philippines. They are in possession of the machinery of milling and that of distribution. Their ramifications of trade extend to all parts of the archipelago. They buy rough rice from the farmers in central Luzon, mill it, and ship the milled product to other parts of the islands where through the shops of other Chinese traders they distribute this cereal food often in exchange for other agricultural products. They have the money and the credit facilities. They have the organization and they reap the reward. The Filipino is the producer and the consumer but the Chinaman skims off the cream of the industry.

Just outside of the town there is a broad river, the Rio Pampanga, which goes on a rampage every rainy season. This explains why the railroad extends no farther. Every year when the dry season sets in the temporary bridge is rebuilt to allow for the heavy rice traffic. It is washed out again when the floods come and the traffic is ferried across for several months. This means that the season of heavy purchase is limited and that the mills to keep running through the year must necessarily store large quantities of paddy rice. It explains also why very few farmers store the grain in store houses of their own.

The town of Cabanatuan is, therefore, an aggregation of mills and storehouses—camarins, as they are called locally. The Manila north road is the main artery carrying into this centre of activity the grist for the mills. Branches extending to the right and to the left from this thoroughfare serve as feeders to swell the volume of paddy rice that converges at this point.

As we cross the river we see this vast current of cereal food flowing in from the north. This season, an unlooked-for flood took the bridge away and interrupted the steady flow of the bull-carts across the river. It became necessary to unload and ferry the sacks across. The conjestion that occurred reached for miles up the road beyond the river as cart upon cart came in and added to the number. Each had to take its turn in crossing the river.

We enter the town in a cloud of dust. The confusion of many bull carts gradually adjusts itself as they turn out to unload at this or that camarin. By the time we reach the R. R. station the last bull cart has found its destination. There is considerable milling around of men and animals going on in front of the camarin as each driver is trying to secure for himself a place of advantage so that he may unload with the least possible physical exertion, but this also adjusts itself, and the empty carts one by one, give place to others that are still loaded.

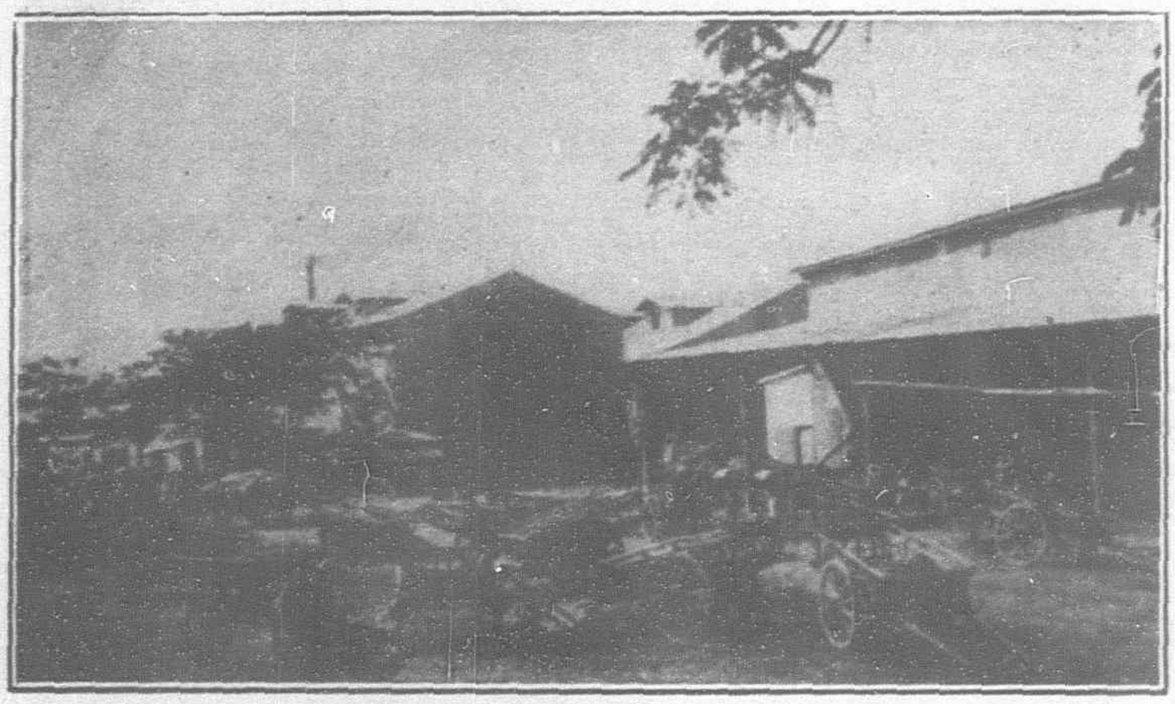
This process is duplicated in scores of other places, some large some small, each owner trying to get for himself his share of the cereal and thereby insure the operation of his mill throughout the year. Others have erected camarins without mills and are buying on speculation in hopes that the price will go up after the rains set in. This it usually does and the owner of the camarin makes a lot of easy money.

At any rate the town of Cabanatuan exists for the purpose of handling the paddy rice grown in the north end of the province of Nueva Ecija. The rapid development of this section resulted in a quick growth of the town which is built of corrugated iron and spread out over several square miles of surface.

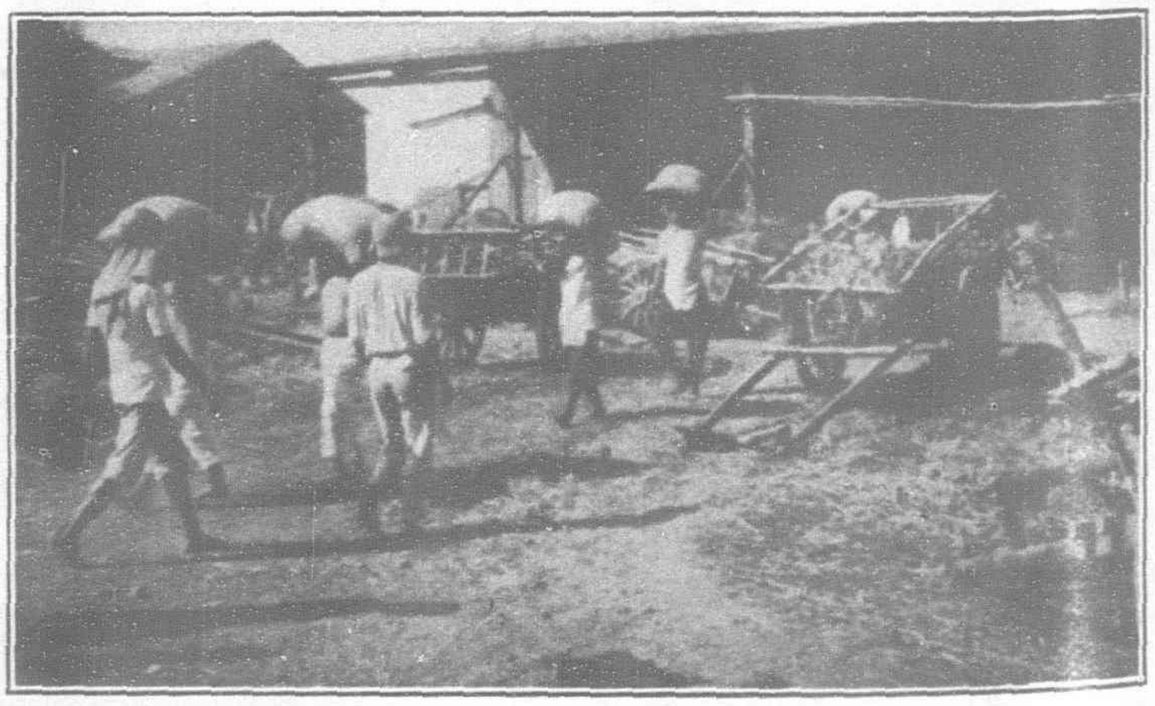
The milling is also a dust-provoking process so that, all in all, the town of Cabanatuan ranks first in dust as well as being the biggest rice centre in the Philippines.

The Process of Milling

A rice mill is not a very complicated affair. The horizontal mill stones remove the husks and the mixture is passed up by elevators and falls into a separator where the hulls are removed



Congestion of Bull Carts at Every Mill



The First Impression of the Rice Industry is the Absence of Labor-saving Devices

and the rice kernals separated, those that are hulled go to one side and those that are still unhulled fall on the other side. The unhulled kernals go back to be ground over again between the mill stones, and the hulled kernels are taken to the next step in the process, the cone or polisher, which takes off the epidermis and leaves the kernal white or pearly. This thin coat is the best portion of the rice kernel and its removal is the cause of beri-beri among rice eaters, but the trade calls for the white and polished product so the mills are all forced to install polishers to meet the requirements of the demand even though it is positively harmful. It will take scientists some years yet to induce the people to eat upolished rice.

The rice that has been polished is ready for market and is carried to the automatic weigher and sacker. When the sacks are filled they are sewed and stacked up on one side ready for shipment as soon as cars can be secured.

The by-products of milling are rice bran (*tiqui-tiqui*), and ground husks (*ipa.*) They are both used for the feeding of animals and served to hogs, cattle and horses.

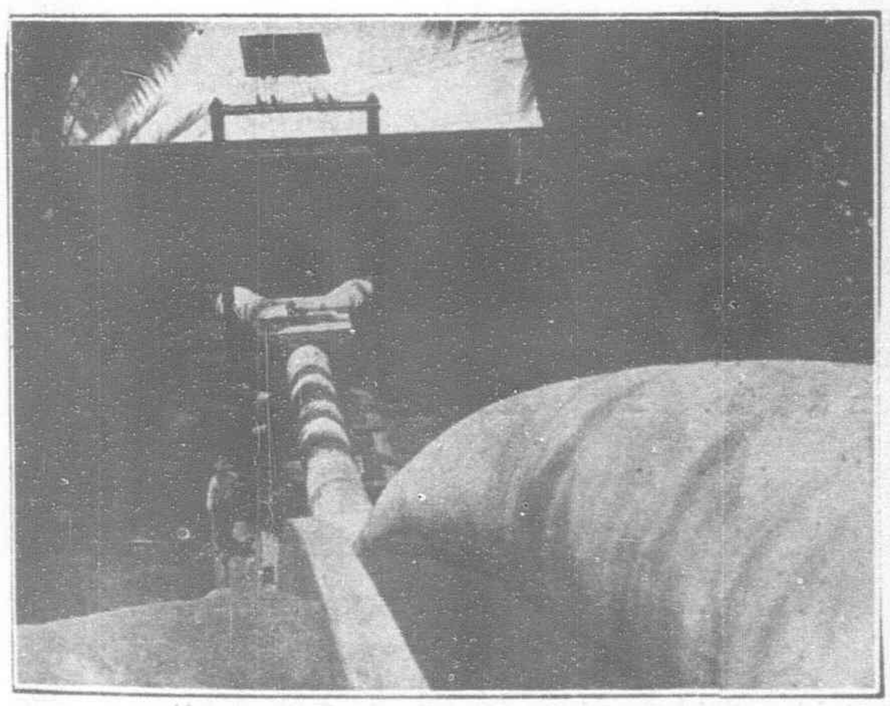
This description meets all the mills, big and small. The units are quite similar except for size. But the capacity of the mill is determined by the number of units rather than the size of each unit. A multiple mill is really a succession of several rice mills operating from one source of power. In Cabanatuan the single unit mill has a capacity of two hundred sacks of hulled rice per day while one of the multiple mills may run as high as a thousand.

In nearly every case the power used is steam generated with rice husks or *ipa* as fuel. An ingenious system of burning the ipa as it drops through space by passing it over a hot blast has been adopted in all these mills so that the utilization of an otherwise worthless commodity becomes one of the chief factors in the operation of the milling process. The milling of rice is consequently a very economical process due to the low cost of fuel.

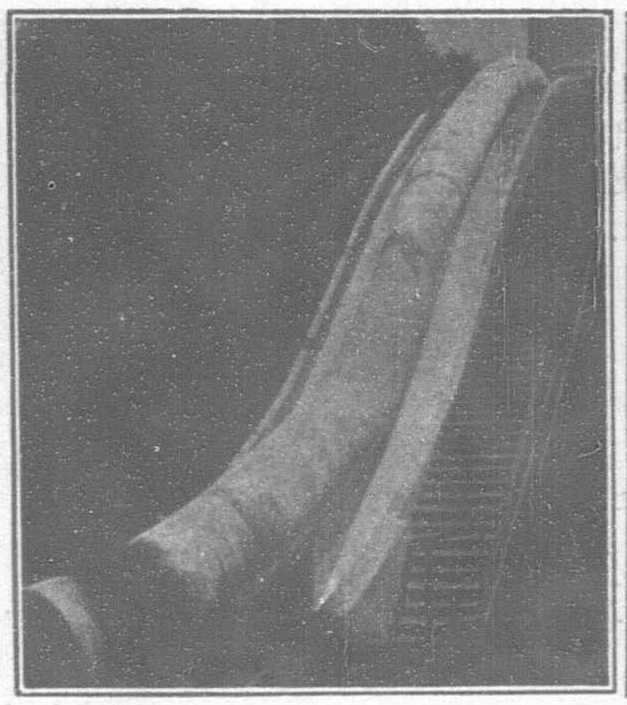
The most imposing part of the plant is the camarin or storehouse in which the year's supply of paddy is stored. This is usually a large barn like affair built of corrugated iron and looms, upon the landscape as an ugly pile of galvanized iron. No conveniences such as elevators to lift the grain to a higher level have been introduced. The brawny strength of half clothed Malays pass in endless procession up an incline of sacks or boards and dump their burdens on the mountain of rice until it climbs to the very eaves. This is hot work and in the superheated atmosphere in the sheet iron enclosure the men perspire freely. Sometimes the homesteaders dump their own loads in this way but usually the owner of the camarin provides laborers for this purpose. He also furnishes sacks to his clients to use for the purpose of bringing the grain to market.

To an occidental the first suggestion that would occur to him in the rice milling industry is the introduction of labor-saving machinery in way of elevators. This is even more to the point when one considers the low cost of fuel and the consequent low operating expense. But man power is chap in the orient, at least every one assumes that to be a fact, and the toiler himself bends, under his load and plods along regardless. Why use machinery to carry the burdens when you can employ men ?

The spur of the railroad known as the Cabanatuan branch is the best feeder along the whole line of the Manila R. R. Co. Heavy trainloads of rice pull out of Cabanatuan at all times of day and night to carry the finished product from this important centre to the consumer on the first lap of its journey. Upon reaching Manila it is transhipped to interisland boats and taken to all parts of the archipelago. Thus the produce of the small farmer from the homestead country of Nueva Ecija finds its way on the tables of other producers who labor to produce other products in distant provinces.



View of Penstock looking down to the Power House



View of Penstock

Switchboards

The Zamboanga Hydro-Electric Plant

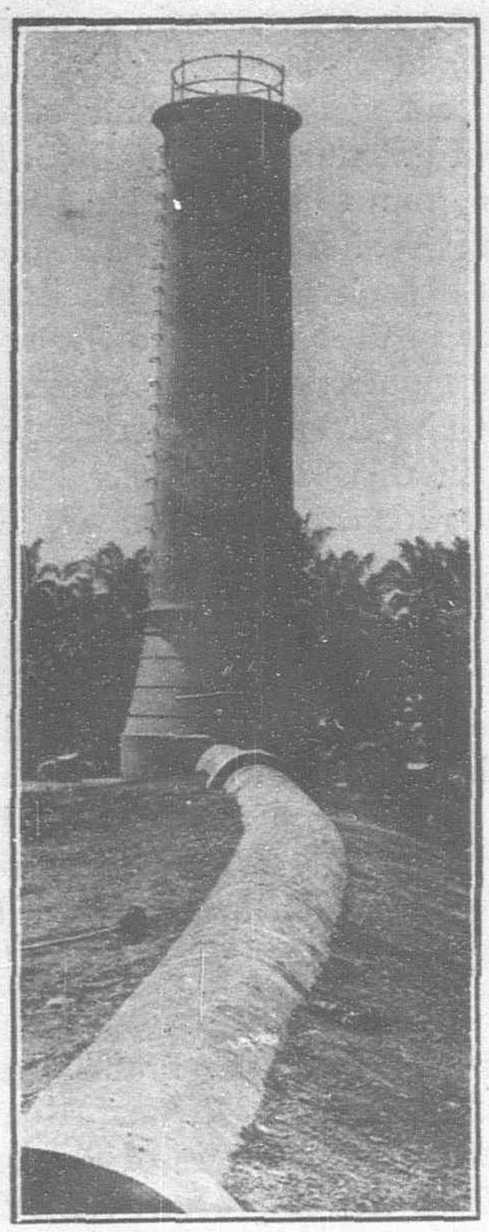
THE Zamboanga hydro-electric system was designed by L. Vincent, supervising electrical and mechanical engineer, of the bureau of public works, and constructed in 1920 under the direction of J. C. Cookingham, then district engineer of the province of Zamboanga.

The water supply is taken from a river about one mile away from the power-house and conducted to a tower of about 32 feet high, which is slightly lower than the water level at the intake. The surplus water is overflowed and conducted to the irrigation canal from where it is distributed to several branches and utilized for irrigating the rice fields in the district of Santa Maria.

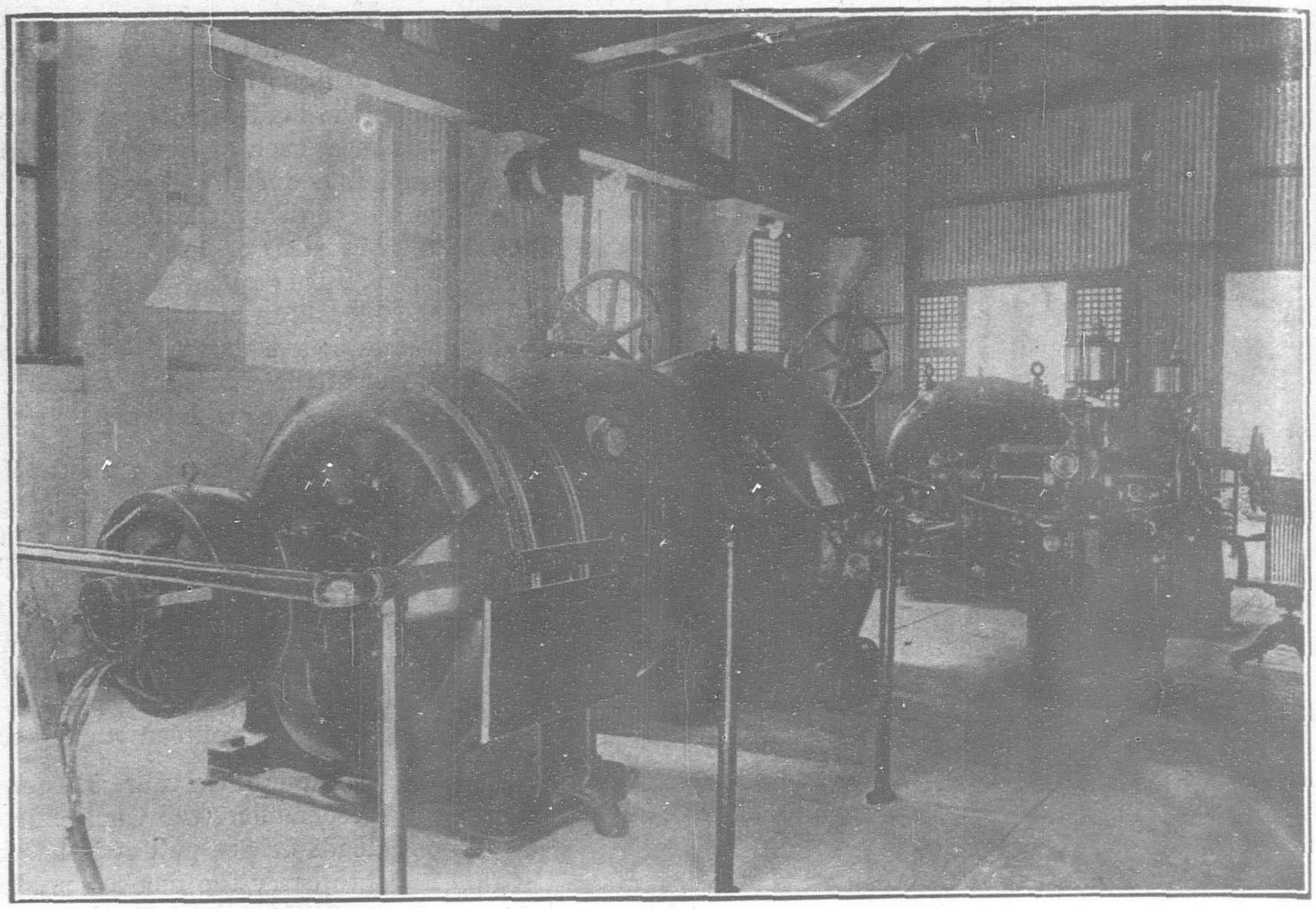
The total head available at the water wheel, that is, the combined height of the tower and the inclined penstock, is about 85 feet giving a pressure of 36-lbs. per square inch.

Two reaction turbines which are directly connected to 150 kw. generator each, are installed in the power-house, and these two generators have separate switchboards which are connected in parallel to a common switchboard. These two General Electric generators of 600 R.P.M. generate electricity of 3,500 volts, 60 cycles, and fed to the feeders at this voltage. The voltage is stepped down in the city by transformers to 220 volts for lighting service and industrial purposes.

The distance of the power-house to the city is about three miles. The plant is a provincial government project and the amount of P.250,000.00 at 5 per cent. interest was borrowed from



Tower with the Supply Pipe from the Intake



Pelton Water Wheels and General Electric Alternators

the insular government purposely for the construction of the hydro-electric system. The total amount invested to finish the project was about P.270,000.00.

High prices of materials and difficvlty of bringing thum to Zamboanga which is about 400 aliles from Manila by sea have caused the initial investment to the system to coem to a very high figure.

At present the plant is selling about 131,000 watts of power per month at 5 centavos per watt which amounts to about P.6,550.00 collection per month, plus the day power used by several motors installed which gives an additional collection of P.400.00 per month. It is hoped that at the end of the year when all the rice-mill and saw-mill motors have been installed, the system will be able to sell the day power to about P.2,000.00 per month.

Wireless Developments in Japan

TELEGRAPHIC communication between Japan and Manchuria has been carried on either between Saseho and Dairen, or between Nagasaki and Dairen. However, with the completion of the wireless station at Port Arthur a great improvement in communication between Japan and Manchuria is effected.

The governor-general of Taiwan recently approved the erection of a new wireless station to effect an improvement in communication with the home country. There is, at present, only one cable line, between Nagasaki and Tamsui.

The Saseho naval depôt has been engaged in the construction of a wireless station at Nario, since 1918. This station is equipped with three triangle steel towers 450-ft. high. It is reported that two towers 300-ft. high for receiving will shortly be erected within the Saseho naval depôt yards.

Wireless Offices in Japan

Official Land Stations :

Location	No.	Under the direction of
Hokkaido	2	Sappore authorities
Tokyo pref.	1	Tokyo ,,
Chiba pref.	1	Tokyo ,,
Okayama pref.	1	Osaka authorities
Wakayama pref.	1	Osaka ,,
Kyoto pref.	1	Osaka ,,
Yamaguchi pref.	1	Hiroshima ,,
Fukushima pref.	1	Sendai ,,
Nagasaki pref.	1	Kumamoto ,,
Kwantung district	1	Kwantung government
Taiwan	1	Taiwan government

Official Marine Stations (On board steamships) :

Belonging to	No.	Belonging to	No.
Nihon Yusen Kaisha ..	16	Tetsudo sho	6
Osaka Shosen Kaisha ..	15	Teishin sho..	4
Toyo Kisen Kaisha ..	3	Noshomu sho	1
South Manchurian Ry. Co.	2	Chosen Sotoku fu	1

Private Land Stations :

Location	No.	Under the direction of
Tokyo pref.	4	Tokyo authorities
Okinawa pref.	2	Kumamoto ,,
Shizuoka pref.	1	Tokyo ,,
Hyogo pref.	1	Osaka ,,
Fukuola pref.	1	Kumamoto ,,

(*Note.*—Of the total, 6 offices, Tokyo, Hyogo and Fukuoka, are for experimental researches only.)

Private Marine Stations (On board steamships) :

Belonging to	No.	Belonging to	No.
Kokusai Kisen K.K. ..	61	N. Y. K.	57
O. S. K.	47	Kawasaki Zosen and Kisen	22
Mitsui Bussan	13	Tatsuuma Kisen K.K. ..	12
Toyo Kisen K.K... ..	11	Kyodo Gyogyo K.K. ..	10
Taiyo Kisen K.K. ..	8	Neiji Kaiun K.K.	8
Katsuta Kisen K.K. ..	7	Yamashita Kisen K.K. ..	7
Iwamoto Kisen K.K. ..	5	Nanyo Yusen K.K. ..	4
Teikoku Kisen K.K. ..	4	Hiroumi Shoji K.K. ..	4
Itaya Shosen K.K. ..	4	Others	55

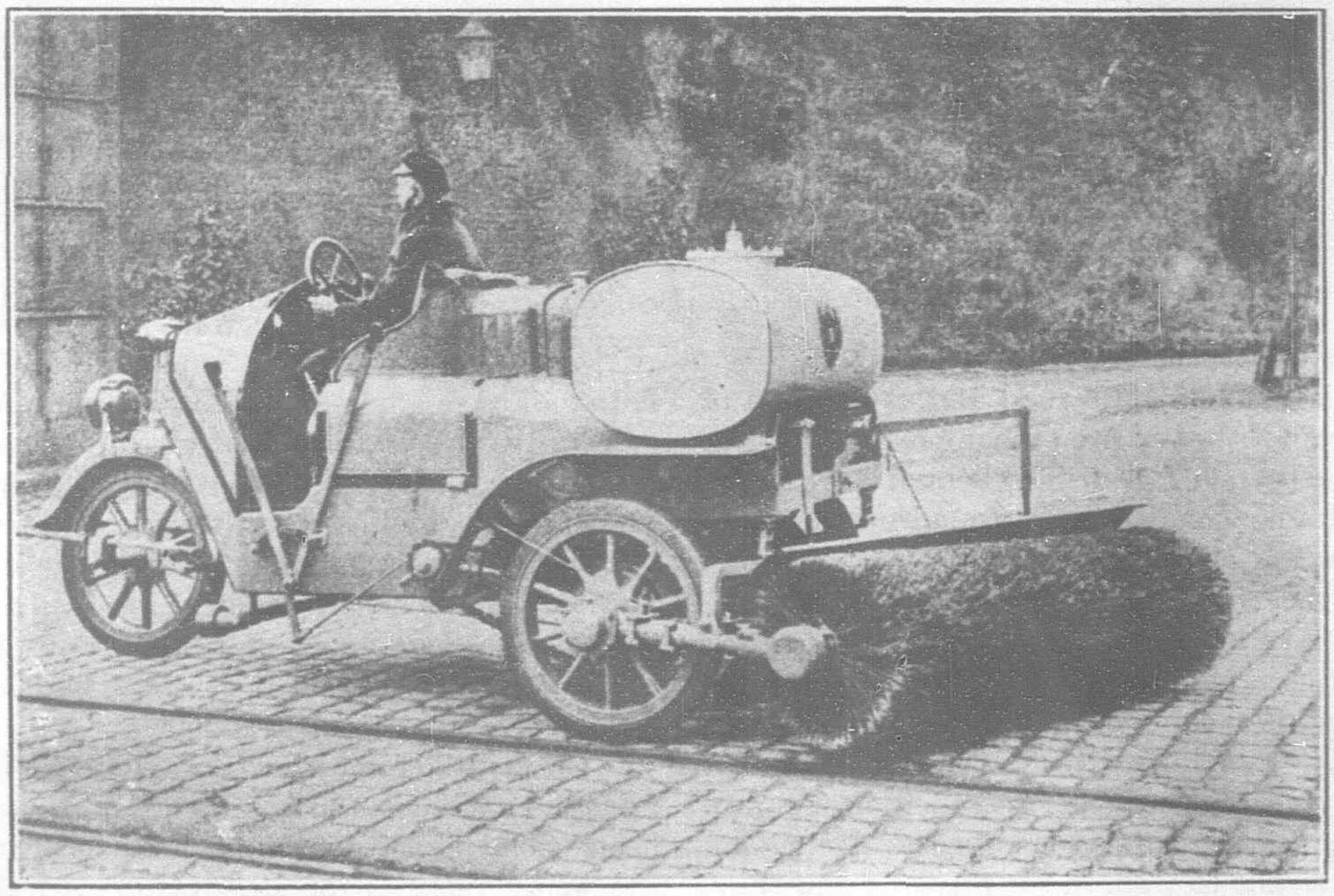
The FAR EASTERN MOTORS
MOTORING - AERONAUTICS - MOTOR BOATING

FAR EASTERN HIGHWAY DEVELOPMENTS

Motor Roads in Japan

Interview with W. I. Irvine, U.S. Trade Commissioner

CHIEF among the handicaps to the development of motor transportation is the lack of preparedness of the country. Industrially Japan has not set its house in order and, although within recent years it has shifted decidedly from an agricultural nation to one of growing industrial strength, the transition is still in progress and old methods continue to be used by the side of the latest devices of industrialism. In the transportation of commodities this is very striking. By factories and mills where the most modern machinery is used, thousands of men are employed to draw heavily ladened carts at the rate of less than two miles an hour, while thousands lead horses or oxen to which are hitched small wagons which at best carry a ton, and generally less, at a speed but slightly in excess of the hand-drawn carts. The streets and roads near the cities are terrible by these slow moving wagons which seriously handicap the comparatively few motor vehicles from operating efficiently and thus further hindering their more general use. The growing cost of labor makes these transportation methods expensive and places an economic burden on Japanese industry which a few of the more far-sighted are realizing. Cheap labor is becoming less a factor in Japan and with its disappearance will go the argumeny that humans as beast of burden are a necessity in order to provide occupation to the thousands of men and women thus employed. And with their passing will come the highway development of which Japan is sorely in need and with which the government is now occupying itself more than at any other time in the history of the nation.



Type of Two Motor Street Sweepers of German Manufacture supplied to the City of Tokyo by Takata & Company

Present State and Proposed Improvements of Highways

Motoring in Japan is an adventure replete with thrills, exasperations, and regrets. Japan offers to the motorist a paradise, but its enjoyment is possible only in a few sections with any degree of comfort. Its natural scenery is full of charm and were the roads fit for motor vehicles it would compell thousands of tourists to tarry longer in the country. The value of travelers is appreciated by the government and in the most important centres agencies have been established to assist tourists in their quest for interest and pleasure. But the great asset of its scenery has been, up to the present, ignored, except in so far as it could be viewed from points accessible by rail road. The Japanese people are nature lovers and will suffer a great deal of inconvenience to visit the famous beauty spots of the islands and were roads suitable to motor traffic available to permit general touring, the market for motor cars opened would satisfy the most ambitious exporter.

The existing roads suitable for motor traffic are few and these in no way compare with the motor highways in America. They are, without exception, as far as the writer was able to locate after a survey which covered the main arteries from Hokkaido, the north

island, to Kyushu, the south island, narrow dirt roads similar to the secondary county roads in the United States. Generally they run through rice growing sections and are elevated above the paddy fields as the irregularly shaped terraced irregated fields are called. The average width is about 16 feet but in many places, even on the main highway of Japan, "The Tokaido," the ancient road which runs from Kyoto to Tokyo, the width is less, so that passing another vehicle is a hazardous task, for there is always the possibility of slipping over the side into a paddy field. It is not only necessary to slow down, but at times to come to a dead stop and then, after one vehicle has been moved as far as possible to the side of the road, the other creeps past. Villages, which are most numerous, usually consist of a row of houses on each side of the road, and in these the highway is almost invariably less wide than the open road, due to the encrochment of shop keepers' stands. Passage through a village is irksome for, in addition to the limited space, the highway is usually full of carts and pedestrians, there being no sidewalks, except here and there in the cities. Some idea of the difficulty of making a motor journey on a busy road in Japan may be gained from the statement that it required two hours for the writer to make the trip of 18 miles between Yokohama and Tokyo. The conditions of this journey were not unusual nor was the time chosen when traffic is unusually heavy. The chief delay is caused in going in and out of the cities for there is but one main road and every kind of vehicle must use it and, if traffic is heavy from the opposite direction, the fast moving vehicle must soon fall in line behind a string of slowly moving carts. A similar condition was found on the short road between Kobe and Osaka.

The roads outside of the cities are good of their kind. The porous soil is covered with layers of river bed gravel which in time is worked into the top making a fair highway. The nature of the soil is such that it drains and it is common, therefore, to find dusty roads a day after a very heavy rain. Near the cities and large town, however, the heavy traffic tears up the roads and then after a rain they are literally a morass. Traffic is further impeded by the lack of sidewalks which compel people to walk in the highway and they, together with the handcarts and rickshas, make driving difficult because of the utter disregard for the rule of the road which is to the left.

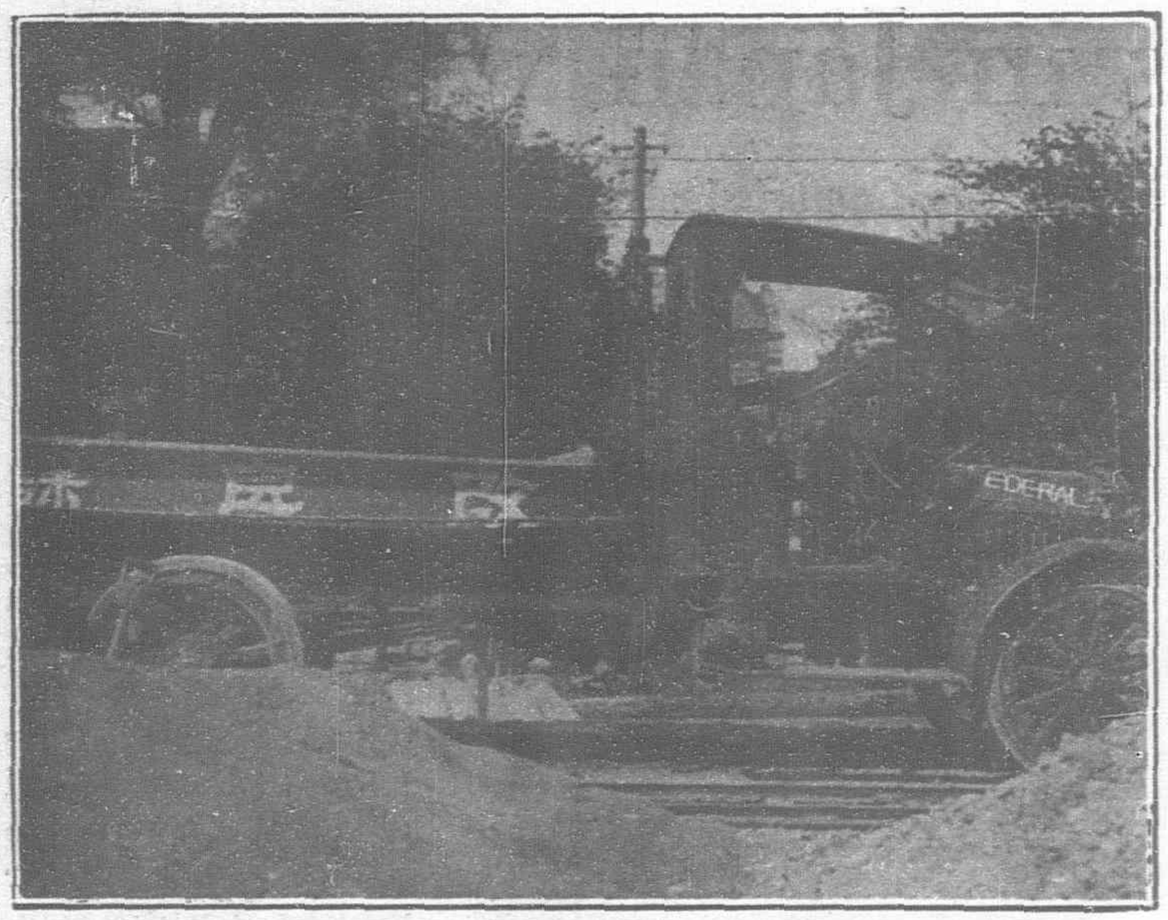
In the cities and towns the streets are generally narrow but the main arteries of traffic are wide and aside from the numerous vehicles which necessitate alert driving and constant horn-blowing, motor vehicles can operate efficiently, although at a higher cost than in America because of the absence of hard surfaces. In Tokyo, with the exception of less than ten miles, all the streets are unpaved. Yokohama, Kobe and Osaka have a few miles of paved streets, but generally speaking the city streets are dirt and, as Japan is one of the rainiest regions, the average record for the whole country reaching as much as 1,570 m.m. a year, muddy streets are common. Japan may approximately be said to have in a year four sunny days for every three days of rain or snow, rain or snow claiming 150 days on an average.

A further difficulty is the absence of straight roads and the weakness of the bridges. In the open country curves are very sinuous and at times complete right angles. The bridges are usually of wood and the strength of the majority does not permit the passage of light motor cars. This condition is so pronounced that it is necessary for army engineers to strengthen all bridges in any section where it is decided to hold manœuvres. In the cities the bridges are stronger over the numerous canals, and so trucks carrying loads of not more than two tons may cross in safety over the majority. Speed is further restricted by the many blind crossings created by the narrow streets and the absence of sidewalks.

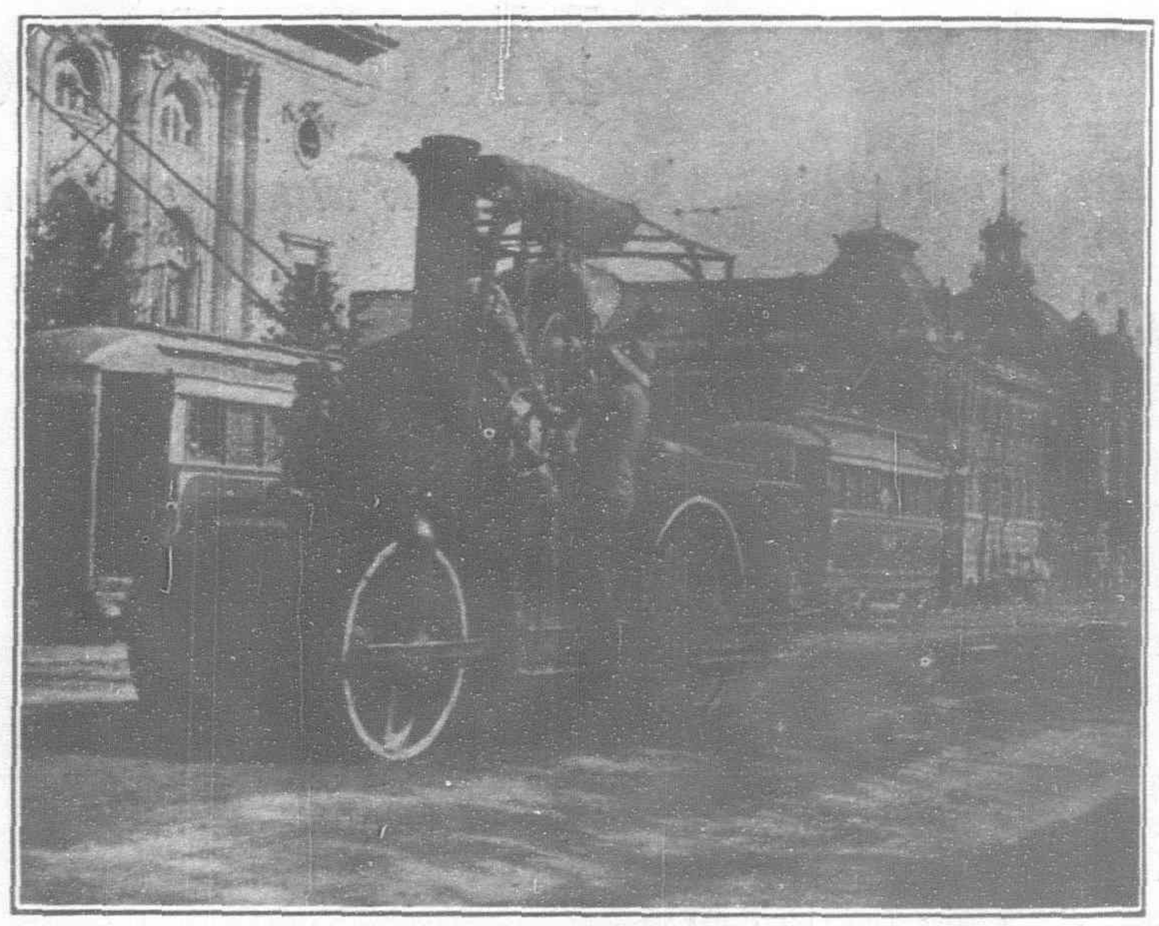
Plans for Improved Highways

Fortunately Japan is not unconscious of the handicap caused by its poor roads and streets, and steps are now being taken to improve its highways. Engineers, municipal, prefectural and national, have studied roads and their buildings abroad and have returned enthusiastic supporters of the good roads movement, but their ardor has been cooled somewhat by the lethargy and procrastination which is characteristic of the Orient. To this is added the further difficulty that the engineers have returned type advocates and the ensuing conflict of ideas has prevented a co-ordination of knowledge and effort. The results of their investigations have materialized so far only in the building of small sample roads, which have been very expensive.

Occidential road engineers and others interested in road building in Japan agree that so far the new streets laid down in Japan have been poorly constructed and an examination of some of these by the writer justifies the statement. An illustration is the recently completed strip of wood block pavement on "The Ginza," the most popular shopping street of Takyo. Two years have been required to lay this street of not more than three miles and although this had been completed less than six months at the time of inspection, the blocks had sunk in many places and bulged in others, and repairs will be in order before another year passes. This is due to the absence of proper base, the method being to lay the blocks on loose and without a binder. However, some streets have been well laid, notably in Osaka, which is by far the most progressive city in Japan in improving its street conditions.



Federal Two-Ton Dump Car, used by the Road Improvement Bureau of Tokyo Municipality



Springfield Road Roller, used in Street Construction Work in Tokyo

Many Japanese road engineers operate on the theory that all that is necessary is to level the road, which is done by hand, cover the surface with river bottom gravel and then roll it incidentally, the steam roller is about the only piece of road machinery used. In the town of Mito where there is an enthusiastic good roads group, streets generally are being "improved" on this basis, but unfortunately for the boosters, the cart and ricksha men, called "*kuramas*," find the pulling hard over the new roads and draw the side and there work a path more to their liking, with the result that traffic passes over only a narrow section which soon becomes as bad as before the improvement, leaving the centre a mass of stones unworked into the surface. This practice is common throughout the country. But this is only a temporary phase and certain to be corrected. The important and gratifying thing from the view-point of the motor man is that the good roads movement has started after years of talk without action.

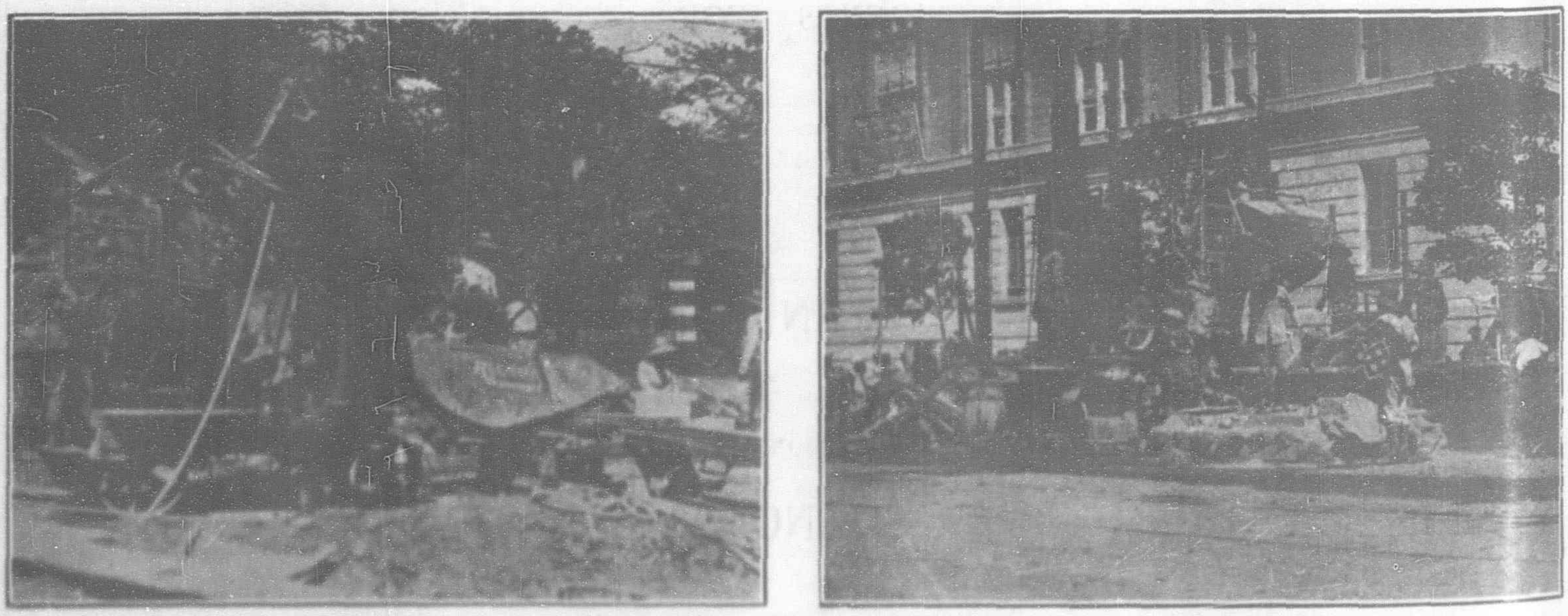
The official figures of the number of miles of roads in Japan are, from the consideration of motor transportation, useless, for they give an erroneous idea of the possibilities for the use of motor vehicles. According to these figures the national roads are supposed to be not less than 40 feet and the prefectural roads 24 feet wide. There are supposed to be 5,299 miles of national roads and approximately 23,886 miles of prefectural roads, and in addition 281,138 miles of country roads sufficiently wide to permit the passage of two vehicles of average tread. There are 346,144 bridges over these roads of which 518 are iron, 71,268 stone and 136,860 of wood, and the balance earth and pontoon. An examination of the roads in widely separated sections of the country showed that the widths are mainly theoretical. Japan is a very mountainous country and this combines with the heavy rainfall, makes road maintenance expensive and difficult. The frequent washouts have reduced the widths of roads and a lack of supervision has lead farmers to encroach on them with the result that in many sections supposed road widths are now parts of paddy fields. Many miles of country roads are in reality nothing but trails over which it would be a physical impossibility for a motor car to pass. For the time being manufacturers who would picture road conditions for the purpose of determining the use of motor vehicles must be satisfied with the statement that with but few êxceptions the national and prefectural highways do not invite motor traffic.

The building of new highways in Japan will necessarily be slow and very expensive for the reason that their construction means the purchasing of adjacent paddy fields and the buying and condemning of thousands of houses. Land is very expensive because of the limited areas for cultivation. An illustration is the estimated cost of the highway between Osaka and Kobe, work on which has been started. It has been decided to build an entirely new route in order to reduce the distance to 15 and ½ miles. The road will cut through not only sections of Kobe and Osaka where houses are numerous but will run straight across paddy fields, generally below the highway level which will call for great fills and the building of bridges. The road is to be 72 feet wide and will be hard surfaced and will cost on an average of $400,000 per mile. A similar situation confronts the builders of the Tokyo-Yokohama road which also has been started. It is estimated that both of these important highways, which will probably double the present use of motor vehicles, will be open within the next three years.

An ambitious national road policy has been launched which covers a period of thirty years and calls for the building of 70 *ri* (1 *ri* 2⅔ miles) of military state roads or national highways, 400 *ri* of prefectural highways and streets in Tokyo, Yokohama, Osaka, Kobe, Nagoya, and Kyoto, the six largest cities in Japan which have a combined population of more than 3,000,000, and are and will continue to be, the principal centres where motor transportation is used. The total cost of the road improvements in the cities is estimated at Y.270,000,000 ($135,000,000), divided as follows: Tokyo, Y.90,000,000 ($45,000,000); Osaka, Y.104,000,000 ($52,000,000); Kyoto and Yokohama, Y.20,000,000 ($10,000,000) each; and in Kobe and Nagoya, Y.18,000,000 ($9,000,000) each. Of this sum the central government will pay Y.90,000,000 ($45,000,000) while the balance will be defrayed by the municipalities. The cost of the state and prefectural roads is estimated at Y.282,000,000 ($141,000,000) of which the central treasury will contribute Y.167,000,000 ($83,500,000). During 1922 of this amount Y.7,000,000) will be spent and Y.9,000,000 ($4,500,000) during 1923. During the succeeding 27 years, Y.10,000,000 ($5,000,000) annually will be spent. About Y.6,800,000 ($3,400,000) have already been spent on this program.

The width of the new roads are to be 24 and 30 feet with gradients of 1 in 30 on hills and 1 in 25 on mountain roads. Many tunnels will have to be constructed and these are to have a standard width of 21 feet and a height of 15-ft. while bridges on these roads are to be rebuilt where necessary with steel or other substantial material with widths ranging from 16 to 24 feet. According to the program of the roads section of the department of home affairs, the improved streets in the city of Tokyo are to have a width of from 36 to 60 feet. The road to connect Tokyo and Yokohama is to be 72 feet wide divided into two side sections each 11½ feet wide for light traffic: a 6-foot sidewalk for pedestrians on each side and gutters 1½ feet. A space of 34 feet is thus provided for fast moving and heavy traffic. The opening of this road will afford great relief to the two cities and will unquestionably result in increased sales of motor vehicles for both passenger and freight. At the present time few vehicles attempt the trip because of the rough going and the slow moving traffic. If the authorities adhere to their plan and lay a

(*Continued on page 360*)



REX CEMENT MIXER USED BY THE TOKYO MUNICIPAL ROAD IMPROVEMENT BUREAU

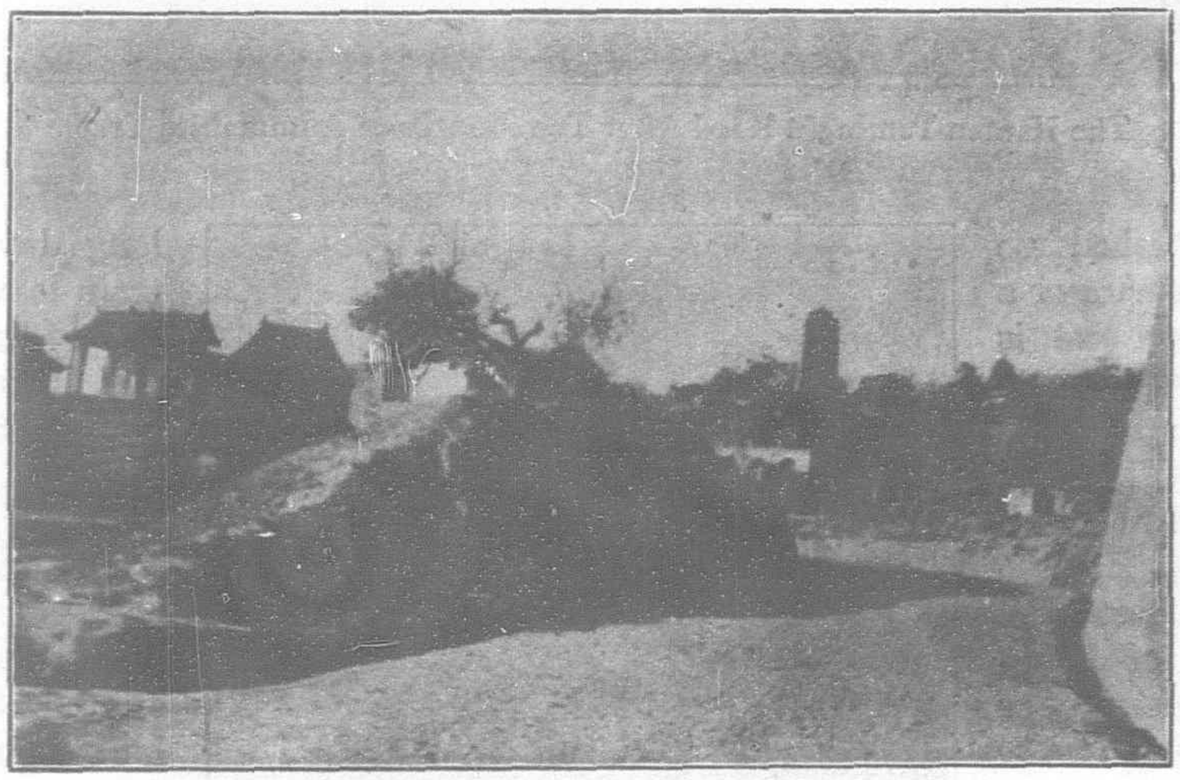
"Do's" and "Dont's" on Chinese Roads

By John Earl Baker

TO urge the building of roads in China has become as safe a topic of conversation as the weather. Every shortage of crop is seized upon as an occasion to promote the building of a road as "famine relief" measure,—outside funds to be used, of course. Those who would disband superfluous troops suggest that they might be used in the construction of roads. It seems to be assumed that a road built from anywhere to nowhere in particular, regardless of length or cost, is desirable as far as it goes. It will do no harm, at least, to examine the subject somewhat analytically.

There is no need to labor the subject of China's wretched roads. Neither is any argument required by the readers of these pages as to the desirability of improved communications in this land of interminable distances. It will probably be accepted on affirmation that for the time being, at least, railway construction on any considerable scale is impossible. Chinese bonds cannot be sold abroad except at ruinous discounts. At home they cannot be sold at all. Government revenues are insufficient for current needs. The present lines are unable to pay bills for materials that are months in arrears. On top of that, the president has declared in a recent interview that "the entire system of big railway loans is wrong. The policy is to be definitely abandoned. The policy we now propose to follow is a system of tenders for materials and contracts for work by railway contractors." This means piecemeal construction, no faster than bills are paid. Evidently, if there is to be any improvement in communications it must be in respect to highways rather than railways for some time to come.

From the standpoint of the credit conditions of the country, highway construction is not impossible. While railways require a great deal of steel, machinery and wood which can be obtained only abroad and at great cost, highways require only labor, the commodity in which China leads the world. Bridges and culverts may be built of brick or stone,—all products of labor. Tools are native made. No machinery is required. Lime and cement are burned locally, in a majority of cases. The engineering is simple. Ordinary eyesight and common sense are usually sufficient, although sometimes it is preferable to "throw dirt with the transit rather than with a shovel."

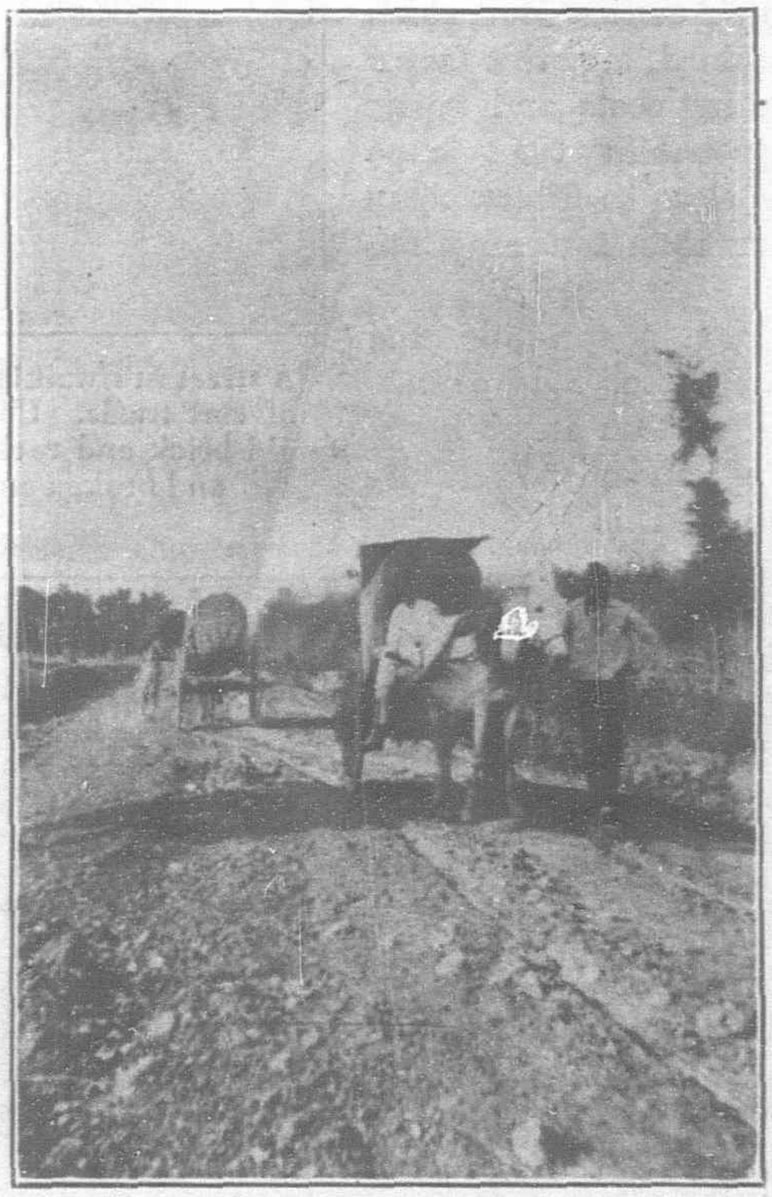


Section of the Yellow River Road, Western Shansi

At the same time there is such a thing as too much enthusiasm concerning highways. Over long distances where traffic is heavy, highways are a wasteful form of transportation, compared with railways. The average rate charged by the Chinese government railways is only a little over half a cent for the haul of a ton of goods one Chinese *li*. The average rate by carts is many times this amount,—at least six times. Within a relatively short distance, therefore, the cost of transportation by cart becomes greater than the original value of the goods carried.

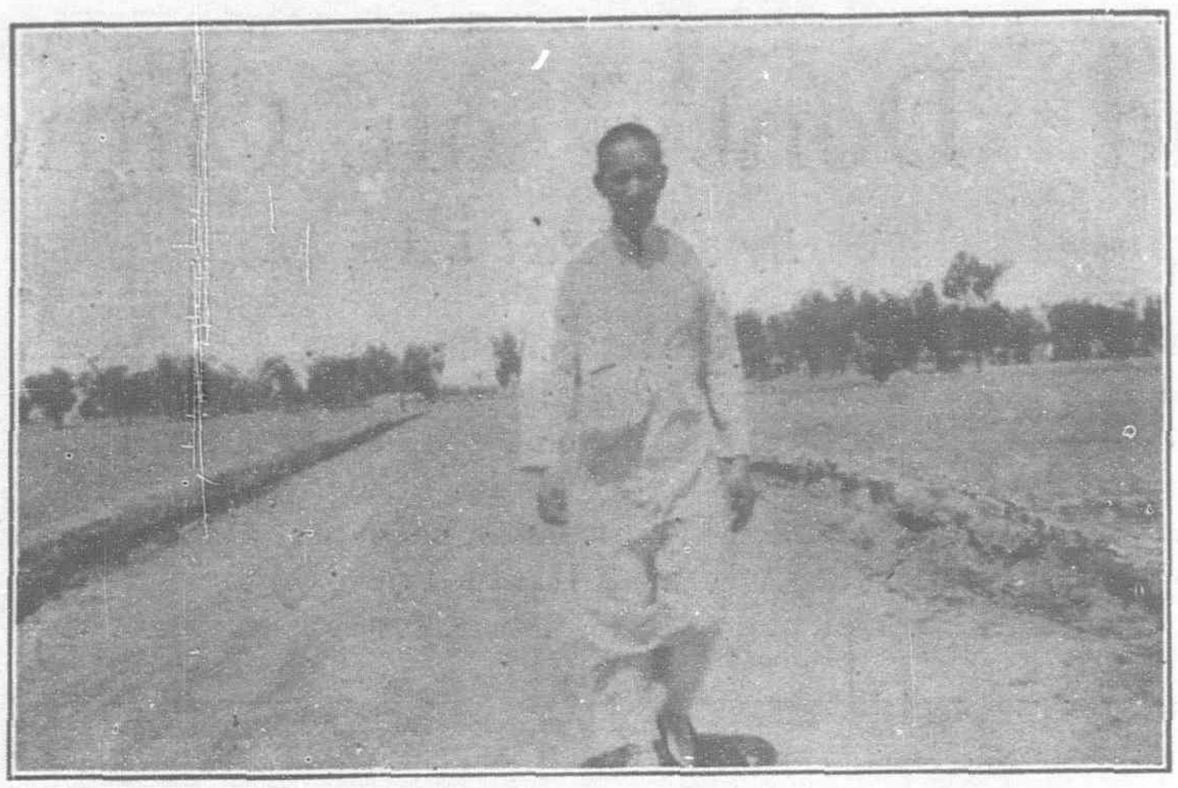
Nor will the use of motor trucks change the situation. Over short distances in Europe and America motor trucks compete successfully with railways; but over long distances they do not. However, European or American experience cannot be followed blindly in China. In America, for example, the highways have been built out of the public domain and so have cost nothing for the land. They have been improved and are maintained by general taxation, so that no tolls are paid and only a moderate license fee is required of the truck owner. Furthermore, labor for the transfer of cargo is very expensive, and it is on the saving of transfer costs from truck to railway at point of origin and from railway to truck at point of destination, that motor transportation of goods thrives in America. In China, by way of contrast, the land for an improved highway in most cases must be

The Yellow River, end of the Red Cross Road. Thousands of tons of grain have been delivered here by boat during the past winter and transported over the new roads to southern Shansi where famine conditions are reported to be as bad as in 1921, were it not for this supply of grain from the outside.



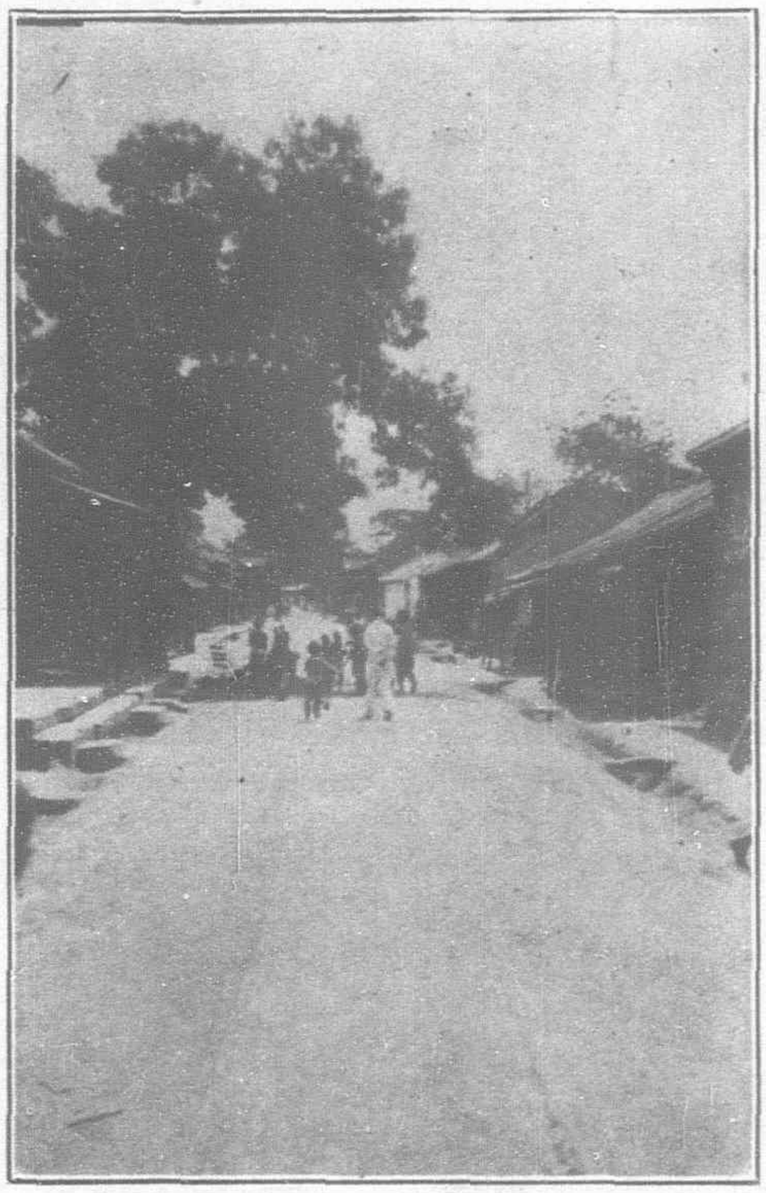
The Honan Macadam Road After Ten Months of Cart Traffic

purchased from private owners. No taxation would be tolerated for a moment either for the purpose of paying for this land, for building the road or for maintaining it after it is built. The road must be projected as a commercial enterprise, and the traffic must bear all of these expenses, which in America or Europe are avoided. And the cost of labor for cargo transfer is so low that in many provinces animals cannot compete with humans in the mere task of dragging the burden.



The Hantan-Tamingfu Road After Ten Months of Automobile Traffic

As a matter of fact, it is very doubtful if motor trucks in China can compete generally with carts open over roads which are furnished free of tolls. Recent data sent from America indicates that the average trucking cost is about five cents gold per ton mile,—all costs included. This is the equivalent to ten cents Mex. for practical purposes. The labor cost for drivers, repairment, etc., will be much cheaper in China than in America. But the cost for gasoline will be double at ports and treble in the interior. The cost of depreciation will be at least fifty per cent. higher and interest will be at least double,—due to the effect of higher first cost and higher rates. Repair parts will cost more and there will be more of them because of inferior care on the part of drivers. In addition, the roads over which the truck in China will operate will rarely be as well constructed nor as well maintained as those in America over which the cost data was obtained, and this factor will increase both running costs and repair charges. Hence, in all probability the average cost in China will be close to fifteen cents Mex. a ton-mile rather than ten cents, the American figure.

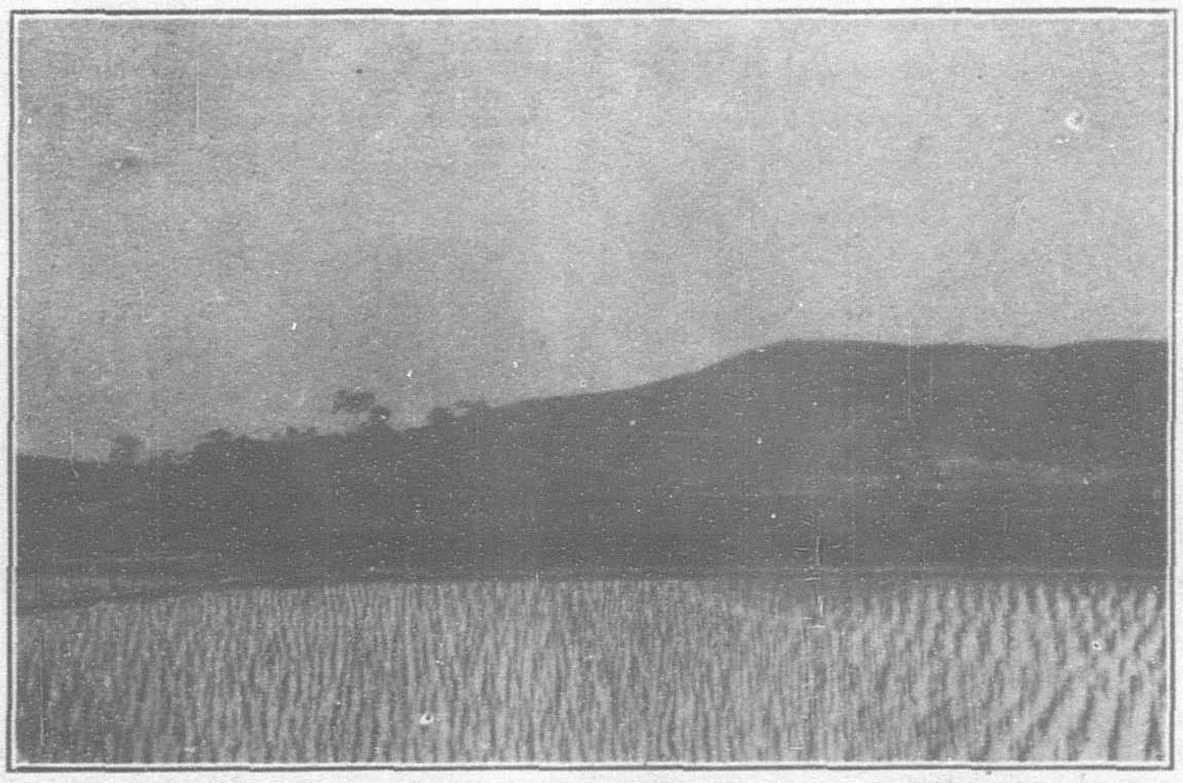


A street in Hwaikiangfu, Honan, after a year of cart traffic. Upon a deep foundation of old brick and rock, a mixture of clay, lime and broken stone was tamped firm

At fifteen cents Mex. a ton-mile, the motor truck on a fairly good road cannot compete with the Chinese cart on an ordinary unimproved road, except under special circumstances. When the road is level and fairly hard cart, traffic costs about ten cents a ton-mile and even under conditions somewhat unfavorable, cart costs do not run beyond fifteen cents a ton-mile. In the case of valuable goods or perishable goods where speed is an object, the motor truck has a field. In other cases, it will have to cut its costs before its use will seriously affect cart traffic, let alone railway traffic over long distances.

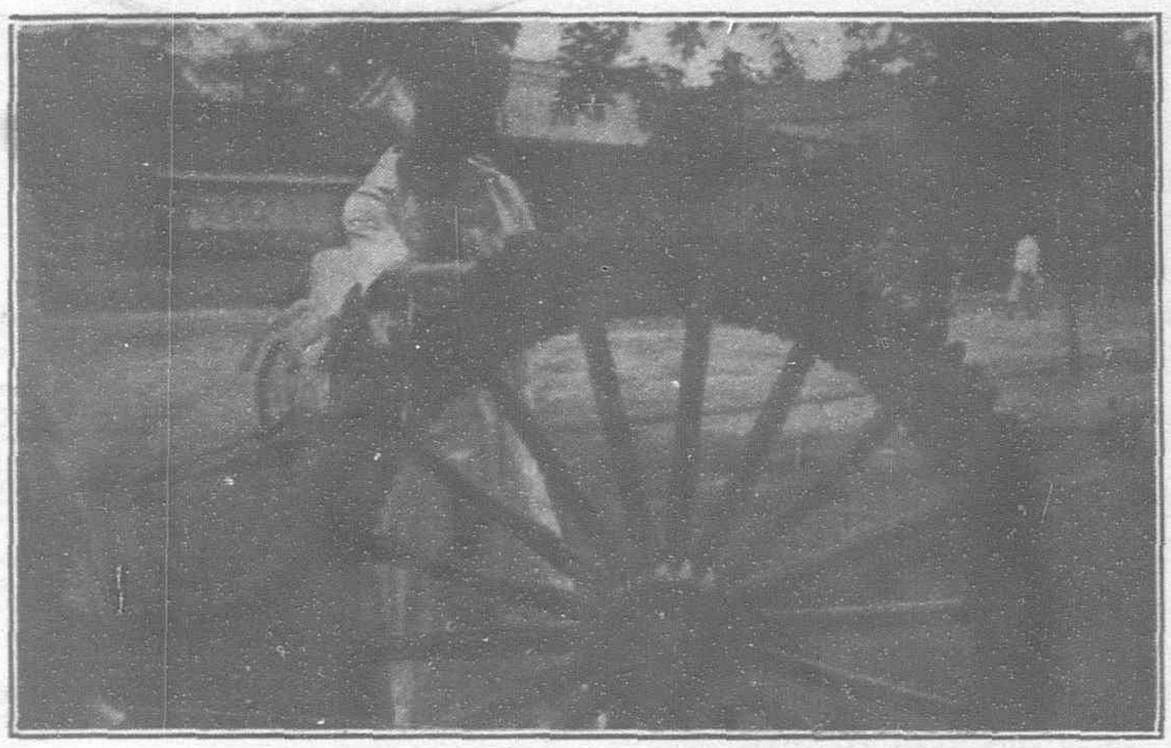
So far, goods traffic has been under consideration. Passenger traffic is a different matter. In spite of trite sayings to the contrary, time does mean something to many Chinese. It means money to the Chinese businessman the same as it does to his western competitor. The time that a well-to-do Chinese can save by the use of a motor car has led to the installation of motor-bus service at several points,—not in competition to the railway but as an adjunct to the railway. In many cases, he finds that by the use of the motor bus he actually saves money. For example, there is the case of the Taiming-fu-Hantan service. Hantan is on the railway. Taiming-fu is forty-six miles away. The train for Peking scheduled to leave Hantan at about two o'clock in the afternoon. The Taiming-fu merchant must allow at least one long day and the full half-day before his train leaves Hantan for the journey,—supposing the weather to be good. His carter will figure on four days for the round-trip and charge him at least $3.00. He must take his bedding and put up at an inn *en route*. He will stop for meals during the day. Being a man of means he will be charged a plenty and must tip liberally. He will be lucky if he gets through for less than another $3.00. If he should have the road luck to be late for the train, there is another day to wait and pay for. But with the motor bus, he need leave home only a few hours before train time. He travels light. He pays only $5.50 for the trip. And think of the extra comfort! And the added safety from possible bandits! Hence, for passenger traffic to points a reasonable distance from the railway there is a distinct place for motor roads,—provided the traffic is sufficiently dense.

With so many opportunities to build, the first choice of roads should be those which would contribute most to the economic welfare of the country. That principle involves two factors: one, the amount of traffic to be transported, and two, the reduction in the carrying cost per unit of traffic effected by the building of the road. The greater the reduction in the unit cost of carriage, the greater the profit from the use of the road and the greater the prospect of developing more traffic. Also, the greater the number of units to which the reduced cost is applied, the greater the aggregate profit from the use of the road. Therefore, roads should be located at first, only between points which interchange a great deal of business. This is a principle which is being lost sight of at times. A second application of the above principles lays in the building of roads between points which at present are required to transport their goods by means of pack animals. An animal hitched



Human beings are the only motive power for transportation across the rice paddies of Hunan. An opportunity for roads as a commercial venture

to a cart will haul on a level, hard road about four times as heavy a load as he can carry on his back. Hence the road effects a saving of three out of four animals, together with one driver, perhaps. On the Yellow River road in west Shansi, it is reported that a cart to which three animals are hitched are hauling the load which formerly required eight animals and two drivers. Grades as sharp as six per cent. are found on this route. Of course, considerable reductions in the cost of transport by cart can be made possible if the present cart roads are improved, but the reduction is not likely to be nearly so large as that brought about by a change from pack animal to cart. It follows then, that the ideal route upon which to locate a road is between two large cities separated by mountains, or upon the mountainous section of some transcontinental trading route.



"Sawtooth" Wheel used on Carts by Fashionable Gentry

Building of roads in mountainous country has other advantages. One of the foremost is that a considerable portion of the land which must be occupied is comparatively worthless. Compared with the cost of farming lands on the plain, this makes the right-of-way much less expensive. However, the additional costs of construction because of the deep cuts and fills necessary to maintain a practicable grade, the bridges and culverts, or paved "dips" necessary to get over water courses will make the mountain road much more expensive in the final cost. Yet, the material for putting on a durable surface is right at hand and need not be hauled, and there is no difficulty in keeping the road up out of flood waters. On the other hand there will be unavoidable trouble with landslides and the washing out of culverts which have not been correctly located, designed and constructed.

If mere improvement of present roads is to be attempted, the best opportunity is over low-lying or marshy regions which during much of the year are impassable by heavily loaded carts. By raising the grade of such routes, providing drainage and surfacing with clay and gravel so as to make a surface which will bake, it is quite possible to make such a route passable during most of the year. A case in point is that of the road built between Chinghua and Tsiyuan via Hwaikingfu, in Honan. At an expense of less the $3,000 per mile, cart charges have been reduced by a third during good weather and by more than half for bad weather.

Under conditions such as have been described, mountainous or marshy, road building can be put on a commercial basis. Take for example the Yellow River road in Shansi. The records of the *likin* station midway of the route showed in 1921 that about 700 tons per day passed he station. The cost of packing goods over this eighty-mile route was about $26.50 per ton. The method has reduced the cost to one-fourth the former level during quiet times and to about one-third the former cost at present, when there is more of a demand for carts than can be met. Assume that an average saving of $16.00 per ton can be effected on the average. This means, when applied to 700 tons, $11,200 per day,—or about $4,000,000 per annum. The road cost only $1,000,000.

At this rate commercial companies have a golden opportunity ahead of them. A highway concession need not involve funds beyond the capacity of Chinese companies to obtain. But far-sighted traffic policies as well as economical construction performance will be necessary in order to make use of such opportunities. A better prospect is offered to enlightened *hsien* officials who happen to be stationed in strategic districts. By a judicious use of tax funds a nucleus for construction can be obtained. If the work is timed to fit in at the slack seasons on the farms, local labor can be obtained cheaply. The wages paid remain right at home, so that the tax-paying powers of the district are not weakened,—but rather are strengthened by this distribution of ready cash. The tolls on the roads then become so much clear gain.

Little or nothing will be gained by improving the ordinary roads down on the plain unless the present type of cart wheel be changed. This wheel, with a tyre only 1¼ Chinese inches broad, if loaded with the usual burden of goods will cut through any surface that has been invented. It was once thought that a "metal" surface of water bound macadam would stand up under this tread. But during the past summer a newly finished street in Peking was worn into ruts three inches deep within two weeks by cart traffic driven by soldiers who were transferring supplies from one side of the city to the other. A macadam road built by the red cross in Honan during the famine was broken through within six months of completion. Once such a road is out of rapair the cost of resurfacing is a serious matter. Besides, any considerable amount of macadam surface is out of the question as a matter of first cost.

Assuming 20-ft. as the width of the road and that a macadam crown of 14-ft. is placed in the oentre, to a depth of 8-in. before rolling. This would give a depth of 8-in. after rolling,—none too much. Each lineal foot of road would contain 9⅓ cubic feet of crushed rock and each mile would contain 49,280 cubic feet. At 100 pounds per cubic foot this computes to about 2,500 tons per mile. If the supply of rock is within a few miles of the highway, this is serious enough, but if it is a hundred miles, as is the case over much of the plain, transportation costs become prohibitive. For the highways in Shantung built by the red cross a mean haul of about 70 miles by rail and 30 miles by cart or wheelbarrow was estimated. This works out to about $100 per mile of highway for rail haul and about $5,000, for cart haul. The rock can be quarried and broken for perhaps $750 and spread and rolled for even less. But the transportation item is tremendous. Still, if the wearing qualities of a macadam road were sufficiently superior, the cost would not be absolutely prohibitive.

The wind is the worst enemy of the rock surfaced road. It whips out the dust between the voids and thus removes the binder which holds the separate pieces solid. The jar of heavy traffic, or the suction of a pneumatic tyre then loosens the small stone. Pits are soon formed and the road becomes so irregular as to have little value over the usual dirt road. Under the traffic of narrow tyred carts, ruts are soon formed and when that takes place, one cart always follows in the track of another until the rut becomes so deep that a new path must be followed. Under these carts the improved dirt road soon becomes no better than the ordinary country road. Hence, no tolls or licenses can be collected for the use of the good road. Hence the conclusion is forced that the present roads down on the plain are plenty good enough for the present type of cart wheel, and that nothing better can be expected.

On the other hand, if a wide type of tyre could be made common, the problem of good roads on the plain would become comparatively simple. If the tyre were of a width of three Chinese inches, or four English inches, the wheel acts as a roller and each succeeding load rolls the road harder and harder. Due to the natural wavering of an animal's progress, instead of following in the same track, the broad tyres tend to roll out the impression of a preceding load rather than to deepen it. If broad tyres were to become common in the couutry, the matter of roads passable to motor cars would become simple. Even in cities with macadam streets, a decided advantage is gained

by their use. The broad tyre tends to wear off the sharp corners of protruding rubble and to pack the binder into the small depressions. This type of wheel has been in use in Taiyuanfu for four years and a beginning is being made on Peking streets. The success in Taiyuanfu influenced Governor Yen to enforce the regulation that none but broad tyres should be used on the new roads built by the red cross and by the military during the past few years.

The whole subject comes down to this. No roads can stand up under the narrow tyre wheel. Until adequate police regulations can be enforced against the use of the narrow tyre on improved roads any expenditure upon either the macadam or the dirt type is money thrown away. On the Tamingfu-Hantan road, carts have been kept off altogether, broad tyres as well as narrow tyres, by the device of digging a well in the middle of the road and cutting a notch in each side of the road opposite the well, on each side of every crossing. Thus, cart animals cannot step across the well nor is there room to turn out. The motor cars, however, can straddle the well. If animals were driven abreast in China, they might do the same, but this is an adaptation that will be years in coming. Under mere rubber-tyre traffic, this dirt road has stood up splendidly, and has been inexpensive to maintain. It is slippery immediately after a rain, and should not be used during the heavy rainy season. If traffic must be constant during the wet spell, the road must be surfaced with gravel.

If any highway program is to be worth what it costs two important lessons must be learned by the Chinese authorities. One of these is regular and adequate maintenance. The other is reasonable loads. In no other connection is the old adage more applicable than in road maintenance that "A stitch in time saves nine." In Shansi, the roads are patrolled by a local repair man who covers a ten-mile section about every two days. He carries a basket at each end of a pole. He has a shovel in one basket and a tamper in the other. If he finds a drain that needs cleaning he fills his basket and carries the dirt to some nearby depression in the road which he fills and tamps hard. If he finds a stone on the road he chucks it into some piece of retaining wall sure to be near by. He inspects licenses of passing carters and acts as highway police as well as repair man. Any unusually large repairs are reported to headquarters and an extra gang takes care of them. Down on the coastal plain, this program would have to be varied somewhat, perhaps, and the use of the "split log" or "king" drag after rains and after the frost comes out of the ground in the spring would make repair economical. But the actual cost of repair can be kept very low by the means just described.

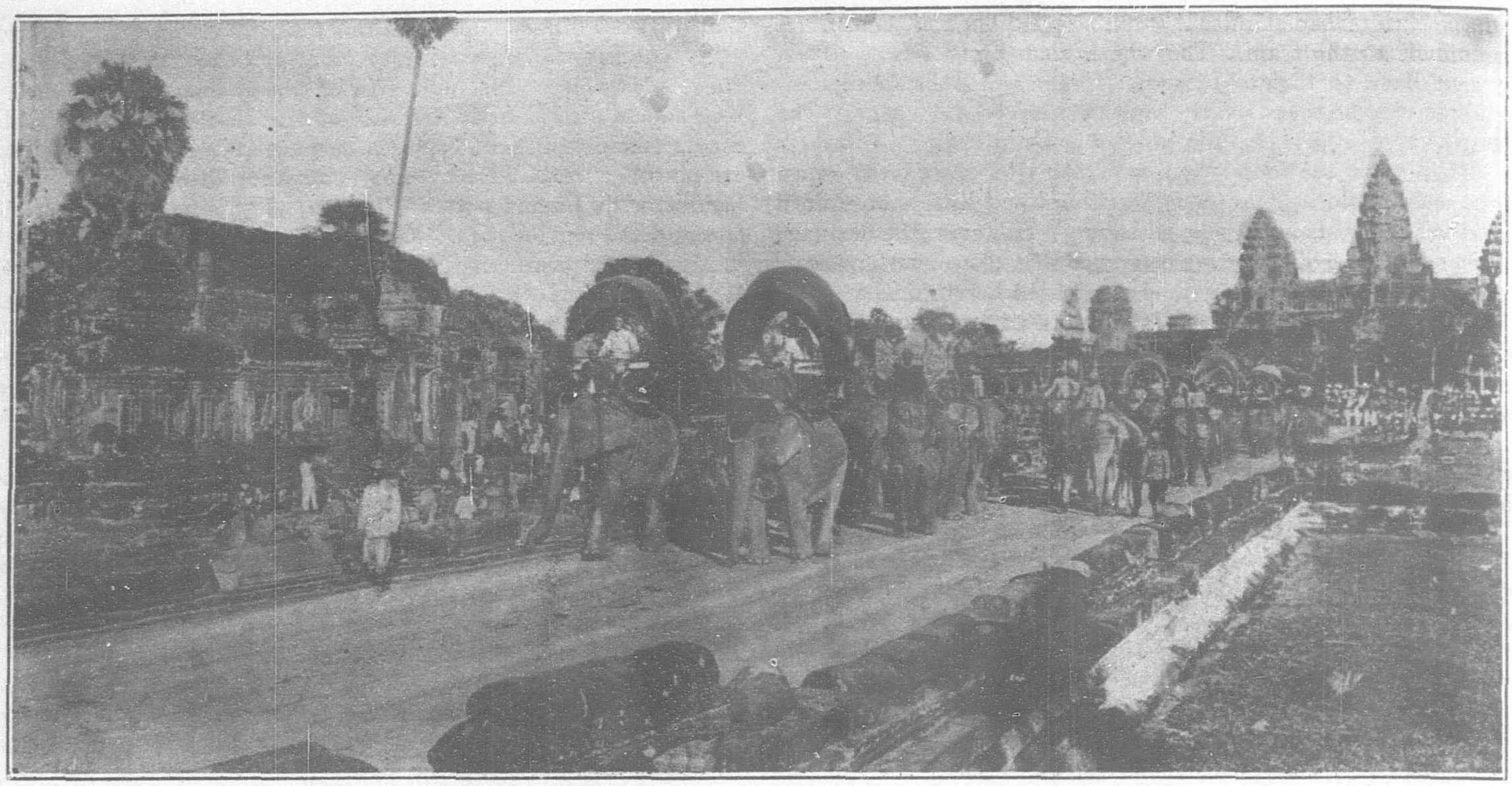
Not only economical repair but successful transport wait upon the learning of the lesson of reasonable loads. Between Hantan and Wuan a fine example of macadam road was built by the Canadian Presbyterians as a famine relief measure in 1920-21. The road was in good shape up to the fall of 1922. Then some enterprising gentlemen became impatient with the profits which they were making from some small motor-busses and fitted up some five-ton trucks. Although these busses were equipped with double treads, these cars soon ground the surface in corrugations and the service had to be discontinued. Two-ton trucks on the macadam road made no impression. They were fitted with single tread pneumatic tyres. Over the dirt road running from Hantan to Tamingfu two-ton trucks were equally harmless.

But the motor car people will learn the lesson of reasonable loads sooner than the carters. The Chinese carter evidently feels that his load is not heavy enough unless the wheels cut in. In Peking the Rockefeller Foundation has equipped sixteen carts with broad tyres and obtained permission from the police to use the macadamized portion of the streets with them. Carts which formerly drew 1,800 to 2,100 pounds of coal are now hauling as much as 4,700 and in few cases less than 4,200. Manifestly, the wheels were never designed to bear such loads and will soon go to pieces unless something is done to correct the practice. On the Hwaiking, Honan, road the same thing happened. Because the wheels did not

cut in, the carters loaded all that could be piled on, and then added more animals to the team. The wheels soon broke down. Then they went back to their old narrow tyre wheels, the foreign innovation having been proved, in their eyes, to be a delusion. The old narrow tyre wheels also did not cut in—until after a few days rain. Then when the foundation gave way, the crust broke down and the wheels churned up mud, big stones and little stones until the road was almost as impassible as before. However, the drainage has been so improved, that even after this experience, cartage costs have been considerably reduced, as mentioned heretofore.

In fact, it seems that if the full benefit of any road improvement is to be obtained, there must be a beginning in the use of the four-wheel wagon. Along winding depressed roads and within twisting *hutungs* such a vehicle is impossible. But upon the broad and straight improved roads where regular transportation takes place there is no reason why these wagons could not be used. The first cost will be greater, but no greater than the cost of two carts, and the four-wheel wagon will carry as much as two moderate cart loads. In this way the full earning power of the driver can be utilized, for he can add to his team, then, all the animals which he can conveniently handle, the same as he does now to the two-wheel cart. But the load, instead of resting on two wheels will rest on four. There is some likelihood that an attempt will be made in Hunan to introduce the four-wheel truck. On the road from Siangtan to Paoking, which is being built with money supplied by the American advisory committee under the supervision of a Chinese-foreign engineering committee, a large amount of gravelling will be done. The beast of burden in that region is the water buffalo. He is a powerful brute. His tractive capacity is probably equal to that of two ordinary mules. If this tremendous force is to be used to its capacity, on this hard and level road, loads up to 3,000 pounds must be expected. No single pair of wheels should be expected to bear such a strain, either for sake of the wheels or for sake of the road. Luckily in that section, no carts whatever are in use. There are no other roads. Everything is transported by boat, by wheelbarrow or by human porter. So there is no danger of a recrudescence of the narrow tyre. Mere principles of economy will be the motive force toward the innovation, and the new mode will be all the easier because there will be nothing almost like it to displace.

Highway programs, therefore, must take into consideration a variety of factors. Nor is it sufficient merely to build them well. They must be located where they will be of considerable service. They must be placed where they have an opportunity to endure. Once built they must be regularly and adequately maintained. They must be policed sufficiently to protect them against misuse. But simultaneously with the building of roads must be a campaign of education with respect to variations in the cart wheel and in the cart itself, in order that the highways which are built may be used to their best advantage. If this is done, highways can become profitable and extensive adjuncts to the transportation system of the country. Over long distances they cannot compete with railways, but they can be the pioneer extensions of railways developing a traffic sufficient to support the railway as soon as built. This is especially true on the plain, where if the road is well laid out, it may become roadbed of the railway. In mountainous territory, however, no economical highway location would be suitable for railway roadbed.



The New Road to the Ruins of Angkor-Vat in Cambodia: Procession of over 90 Elephants in Honor of the Visit of Marshal Joffre

The Roads of Indo-China

THE length of the roads of the colony which has doubled since 1912 now attains over 16,800 miles, of which 6,200 miles are metalled and 6,000 miles are graded, thus being available for motor traffic for the greater part of the year.

These roads in accordance with the governor-general's order of June 18, 1918 are divided into colonial roads and local roads and, in Cochin-China only, into provincial and comunal roads.

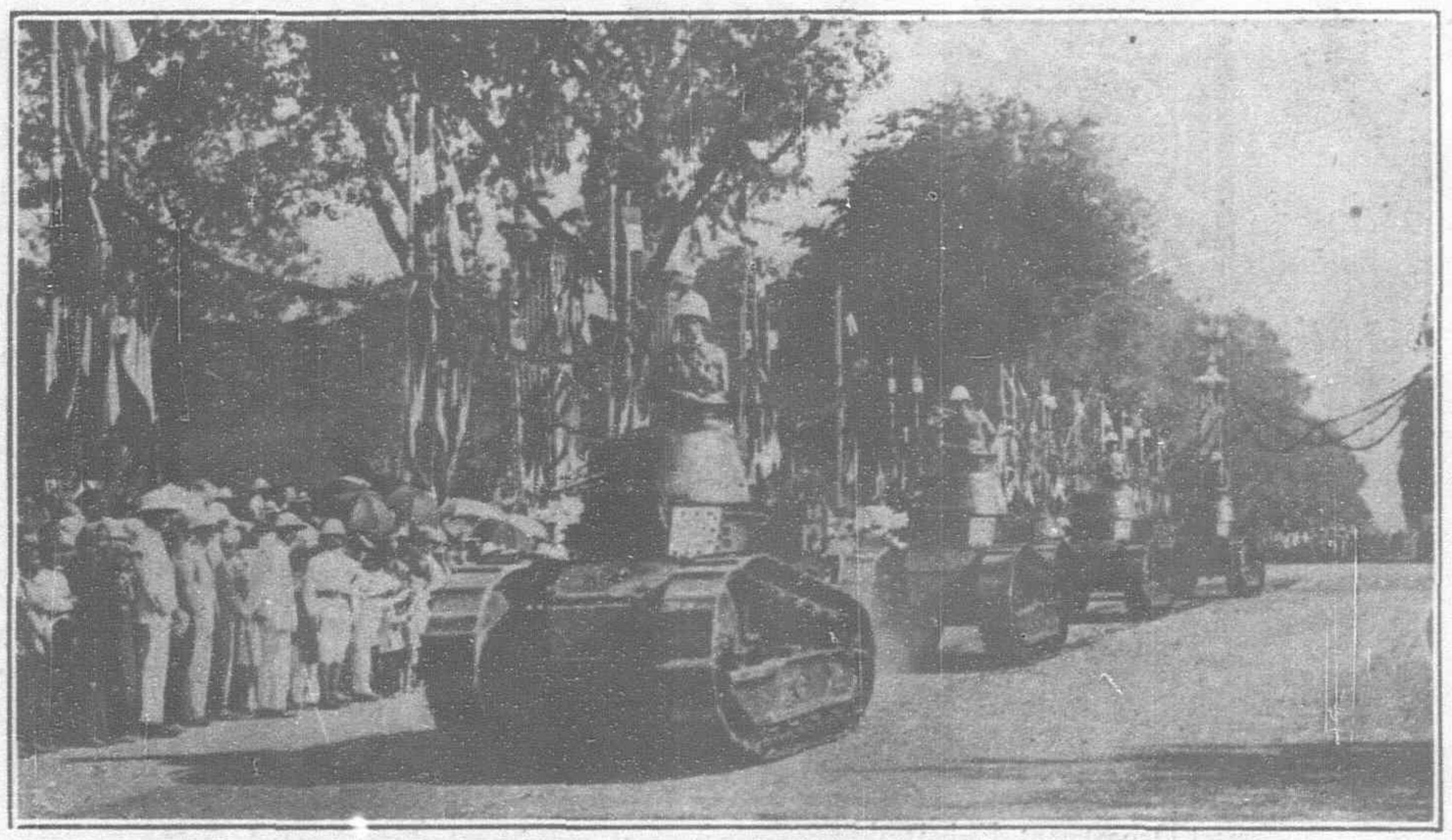
I. General

A. Colonial Roads

Colonial roads are to the colony what the national roads are to France, for they equally serve the country as a whole. The programme now being carried out provides for 16 highroads in accordance with the order of June 18, 1918, to which two more have since been added. The most important is colonial road No. 1 or mandarin road, running from the gate of China to the frontier of Siam, via Langson, Hanoï, Hue, Saïgon and Pnom-Penn. This road is the great artery of land travel between north and south and connects up the capitals of Tonkin, Annam, Cochin-China and Cambodia. Its total length is 1,545 miles, slightly further than the distances as the crow flies between Paris and Moscow or Marseilles and Alexandria.

Until seven or eight years ago the greater part of the mandarin road existed practically in name only, for on a few sections only could rickshaws and light carriages be used, whereas all the rest was passable only on foot or in the saddle, the track crossing straight over passes by means of steps. The usual means of travel was the palankeen or sedan-chair and all luggage was carried by coolies, so that quite a caravan was necessary for the smallest journey. The postal service was undertaken by coolies.

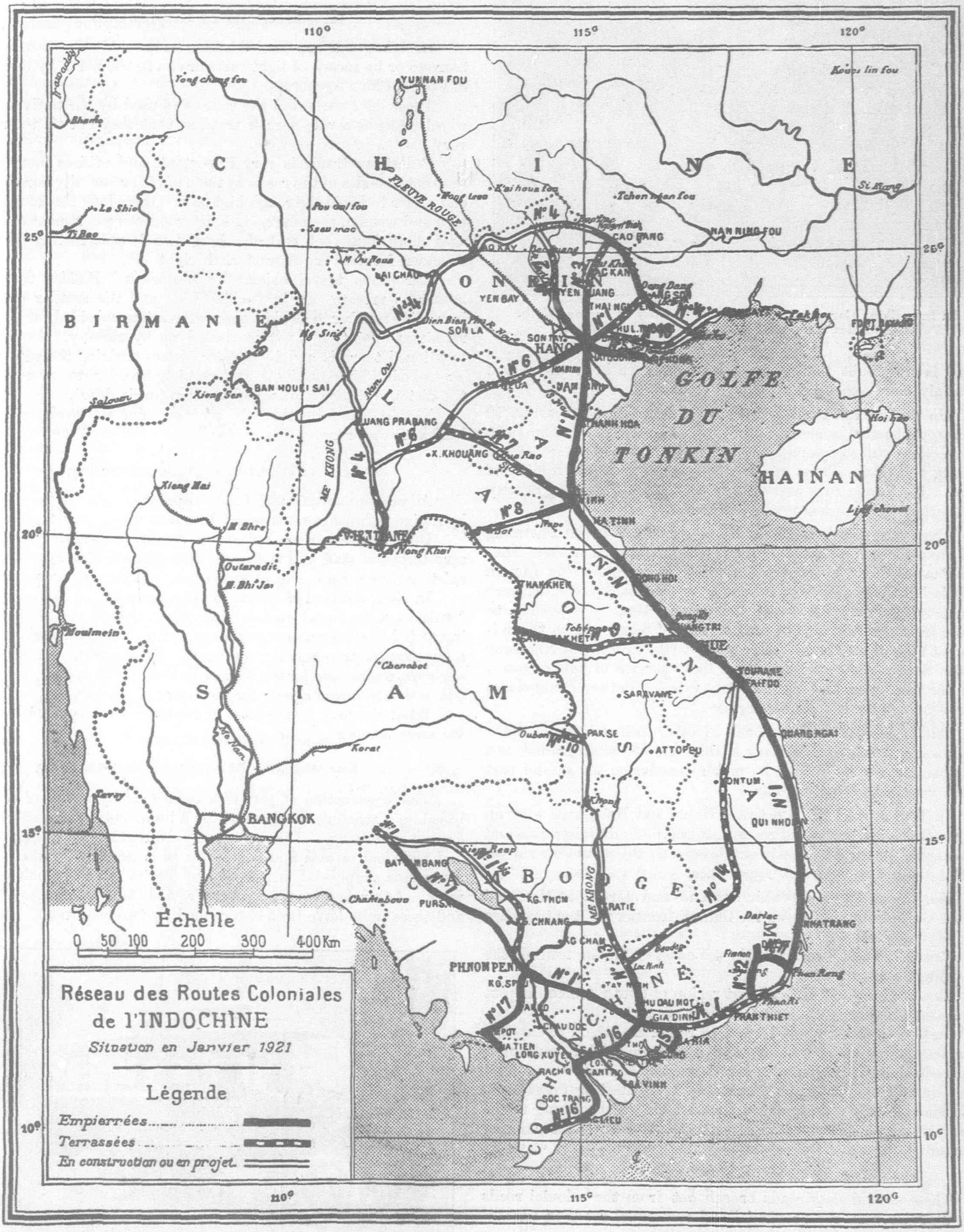
In 1913 it was decided to make this into a serviceable road and the work was commenced the same year and has been steadily continued without any breaks, every year important credits for this being included in the general budget.



Parade of the Tank Corps of the Colonial Infantry at Saigon

The standard width of the actual road is 19-ft. 8-in. The radius of curves is never less than 49-ft. 2-in. and gradients are only exceptionally 1 in 17. Bridges are for the greater part in armored concrete and are calculated for a rolling load of nine tons.

The work was attacked simultaneously all along the line by means of small contracts so as to utilize small local contractors and labor. Had the usual western system of large contracts been employed



Réseau des Routes Coloniales de l'INDOCHINE

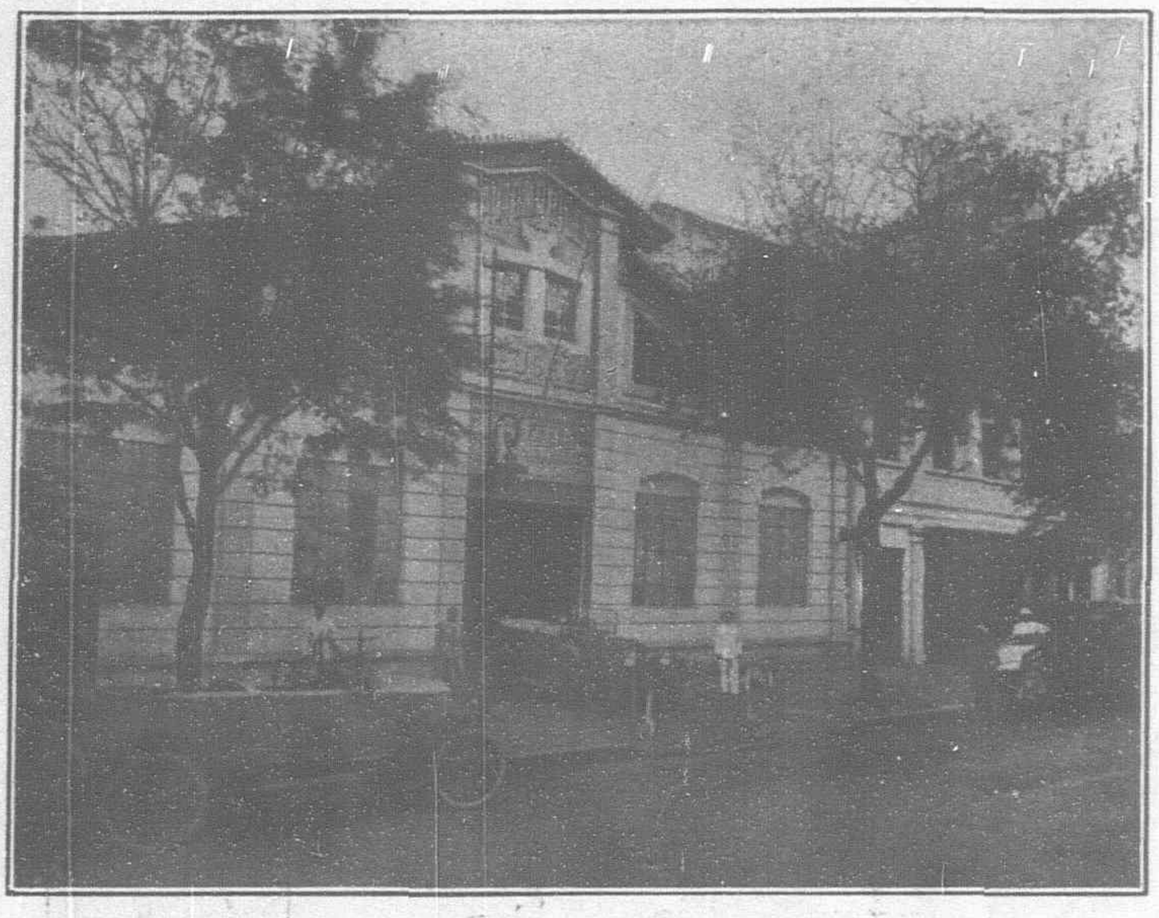
Situation en Janvier 1921

Légende

Empierrées

Terrassées

En construction ou en projet.



An Indo-China Garage: The "Peugeot" Agency at Saigon, of the Societe des Automobiles et Cycles de l'Indo-Chine

there is no doubt that the work would have been slower and certainly more expensive.

Up to date 1,384 miles of this road are metalled (nearly 9/10 of its total length), some 65 miles having been carried out in 1920. The sections still to complete are on the one hand at the frontier of Annam and Cochin-China and on the other close to the frontier of Siam. The former runs parallel with the Saïgon-Nha-trang railway and is therefore of a less urgent nature.

That part of colonial road No. 1 running between Phanrang and Phan-tiet is duplicated by roads No. 11 and 12 (Tur-sham-Fim-non-Phan-tiet). The lengths Phan-tiet Jiara connecting Annam and Cochin-China and from Sesophon to the Siamese frontier were completed in 1922. Even at the present time it is possible to motor from the frontier of China to that of Siam. From the rail-head at Vinh of the Hanoï-Vinh railway to the railhead at Nhatrang of the Saigon-Nha-trang railway a daily service of public motor-cars for passengers and mails already exists. Between Saigon and Pnom-Penn there is a similar service.

Out of the 3,970 miles of the 17 other colonial roads, 1,471 miles were metalled on January 1, 1922 and 956 miles graded, and they can already be utilized by motor-cars during the greater part of the year. The chief ones are :

In Tonkin road No. 5 between Hanoï and Haï-phong with an extremely heavy traffic and roads 2, 3 and 6 of administrative and commercial importance between Hanoï and the mountain regions of Haï-Jiang, Cao-bang and Upper Laos.

No. 4 runs between Tonkin and Laos and starting at Mong-hai on the Gulf of Tonkin follows the Chinese frontier till it enters Laos and attains Vientian.

Roads 7, 8 and 9 run from the sea-coast of Annam towards the Me-kong River in Laos.

Roads 11 and 12 in the Dalat region of South Annam help to fill up the existing gap in road 1.

In Cochin-China roads 15 and 16 run from Saïgon to Cape St. Jacques and Cape Camao respectively, and road 1 penetrates Cambodia joining Saïgon with Kratie on the Me-kong River.

In Cambodia are to be found road 17 connecting Pnom-Penn with Ha-tien on the sea-coast and road 1 bis which passing to the north of the Great Lakes finally attains the marvellous ruins of Angkor.

B. Second-Class Roads

These second-class roads branch out from the colonial roads and together with the provincial and communal roads of Cochin-China aggregate some 11,800 miles, of which three quarters at least can be utilized by motor-cars during the greater part of year (1,370 miles metalled and 735 miles graded). They correspond to the depa tmental and communal roads in France and are naturally few and far between in the mountains of Tonkin and Upper Laos. but there are many more in the thickly populated palins and deltas,

II. Methods of Circulation

In Asia goods are carried either on men's backs or in wheel-barrows or by means of light carts drawn in the north by men and in Cochin-China by horses.

These light carts and the rickshaws used by the natives have wheels with as a rule narrow tread so that they cut up the roads very badly.

Pedestrian traffic is very important, and utilizes more often than not the sides of the roads as the natives are usually bare-footed and prefer to avoid the rough highway. These long files of natives, men and women, each carrying a heterogenous assortment of packages slung from each end of a long flexible pole resting on their shoulder, form a very characteristic sight.

Europeans travel chiefly by motor-car. Besides the very numerous private cars in Cochin-China and the smaller but fast increasing number in Tonkin, there are various subsided car services running to points not yet connected up by railway. As already mentioned there is a daily service of cars covering the gap in the Trans-Indo-Chinese Railway and enabling travelers to cover by land the distance between Hanoï and Saïgon (in six days).

Tourist cars form the bulk of those using the roads, as heavy lorries are still rare.

III. Planning and Constructing

All preliminary plans are made under the control of the engineer by native technical agents assisted by men who clear the ground.

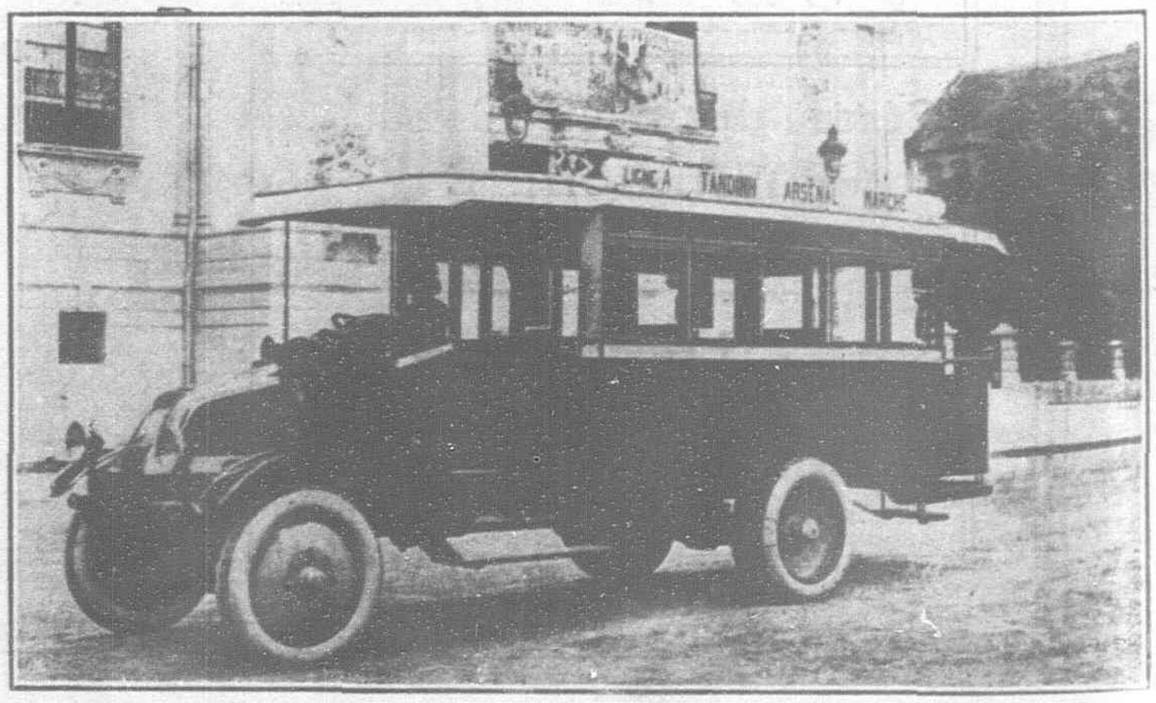
Unfortunately it was not always possible to acquire the necessary technical staff and it became sometimes necessary to enlarge existing native roads and paths without preliminary planning.

In 1902, a school of public works was opened in Hanoï, which furnishes a technical native staff who, though not sufficiently instructed to efficiently get out plans, yet perform good service after a few months' training on the ground. These agents can, under an engineer, replace the former European staff. This school also turns out native technical agents for the board of surveys.

Whatever may be the class of road, the work is carried out in the same manner.

A. Grading and Building of Bridges, Etc.

The construction of part of a road is let by means of tenders based on a schedule. Contracts for a lump sum or in competition are not admissible. These contracts are regulated by the general and technical clauses and conditions as is usual in France. The contractor supplies all materials and carries out the whole of the work. As a rule a contract covers from six to twelve miles of road and these units have been determined by two conditions. On the



Bus Body Built at the Works of C. Perrin, Saigon: Renault Ageucy

too high and contractors would have hesitated before undertaking the work. On the other hand, if too large, it would have been one hand, if made too small, the general expenses would have been difficult to let the contracts as the contractors were more often than not natives, some of whom were of modest means and, although they efficiently ran their own small businesses, were not in a position to undertake a big job, and for this reason the choice of contractors would have been limited.

Where the native contractor was well off, his business was often inefficiently run or sub-let to incapable Caïs (master workmen) or to smaller contractors, which would have introduced useless middlemen with attendant extra expense. Few Europeans are to be found among the contractors.

The road-bed is generally 16-ft. 6-in. wide except where from motives of economy or in mountain districts it was occasionally reduced to 14-ft. 9-in. or even 13-ft.

Most of the bridges are from 11-ft. 2-in. to 12-ft. 6-in. in width, including a path of 1-ft. 4-in. on either side. These are certainly somewhat narrow, but all those of a later type, which like some of the old ones are all constructed of armored concrete, can easily be widened later on.

These newer bridges are generally calculated according to the latest French official regulations and are able to carry the loads therein specified. This unhappily is not the case with the numerous older bridges and culverts which are often in metal; they will be, however, gradually replaced or encased in concrete.

B. Metalling of New Roads

This is invariably carried out by schedule, and the metalling is laid without upright stones; the first lot is laid allowing for from 950 to 1,050 cubic yards per mile on a width of 9-ft. 10-in. to 13-ft. The stone used is often limestone or Bien-hoa stone (laterite) these being almost the only stones available in the deltas of Tonkin and Cochin-China. At the present time, however, stones of igneous origin, such as granite, quarzite and rhyolite, are being more and more utilized especially where the traffic is great, as limestone wears too rapidly. The camber of the roads had been diminished and is now from 1/80 to 1/100.

C. Maintenance

The roads are maintained by roadmen working more and more in gangs, supplemented by special gangs to meet special cases.

Remetalling is carried out similarly to the original metalling allowing from 630 to 735 cubic yards of stone per mile.

For surface repairing more and more use is made of broken stone, laid without previous scarifying of the road, at the rate of from 85 to 105 cubic yards per mile.

The material is supplied by contract or by tenders; the actual mending is as a rule done by schedule.

In the mountain regions, where most of the roads with the exception of the colonial roads, are little more than tracks or paths, the maintenance is undertaken by the villagers to whom small subsidies are allowed where work in kind has been redeemed by the villages as is the case more particularly in Tonkin.

IV. Machines Employed

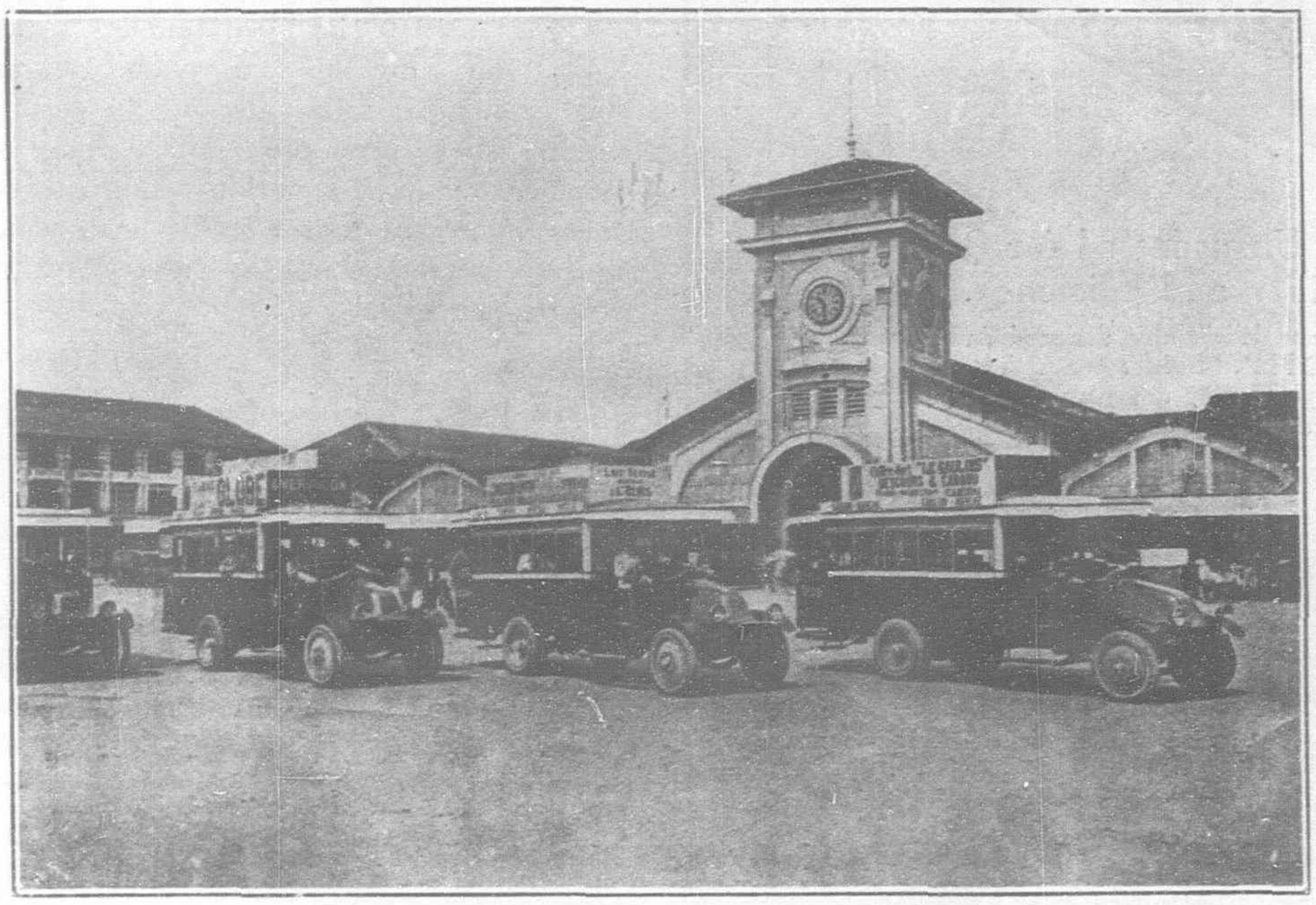
These are confined almost exclusively to road-rollers. Diggers and excavating machines would be of little use as the cuttings are rarely deep and the difficulty of bringing such ponderous machines up to the working face would be practically insurmountable. Further the natives evince great repugnance to working with modern appliances and cases have even occurred of their flatly refusing to make use of the usual portable contractor's lines.

The public works department possess a very large number of hand rollers, weighing about 2½ tons but as these wear out they are not renewed, but replaced by steam rollers of from four to ten tons of the usual French type.

This material is divided among the different countries as follows:

Steam-rollers of the following weights:

In Tonkin.	In Cambodia.	In Cochin-China,
1 of 5 tons	1 of 3.5 tons	9 under 6 tons
3 of 6.3 ,,	2 of 4 ,,	7 from 6 to 9 tons
6 ,, 6.5 ,,	2 ,, 5 ,,	5 of 9 tons over
8 ,, 8 ,,	7 ,, 7 ,,	
2 ,, 9.5 ,,	6 ,, 7.5 ,,	21
2 ,, 10 ,,	2 ,, 8 ,,	In Annam, In Laos.
	2 ,, 9 ,,	5 of 4 tons 7 of 5 tons
22	3 ,, 10 ,,	4 ,, 5 ,, In Dalat
	1 ,, 13 ,,	2 ,, 6.5 ,, 1 of 4 tons
		3 ,, 7 ,, 8 ,, 5 ,,
	26	1 ,, 9 ,,
		15 9



The Bus Terminal at the Central Market, Saigon

Making 100 steam-rollers in all, only one of which is more than ten tons, all the others being comprised between four and ten tons.

The somewhat feeble weight of these rollers is necessary on account of the softness of the stone hitherto employed, but harder stone is being more and more introduced.

Besides the steam-rollers watering-carts of the usual French construction are employed.

This material has proved insufficient and the public works department proposes to acquire "Albaret" steam-rollers; as follows:

For Tonkin: 2 of from 8 to 12 tons; for Cochin-China: 1 of 4 and 4 of 5 tons; for Annam: 4 of 6 tons; for Cambodia: 4 of 8 tons and 2 of 10 tons; for Laos: 3 of 5 tons and for Dalat, 3 of 7 tons.

The department also possesses a stock of Decauville light railways of 50 and 60 cm gauge (1-ft. 7⅝-in. to 1-ft. 11⅝-in.) of which 7½ miles are in Tonkin, 1¼ miles in Cochin-China, 5 miles in Annam, 67 miles in Cambodia, 64¾ miles in Laos and 28 miles in Dalat.

V. Present State and Cost of Road-making

1. Colonial Roads

Ever since 1912 important credits for the making of colonial roads have been included in each of the general budgets. Out of a total sum of 51,500,000 piastres for which provision has been

made some 28,400,000 piastres have already been spent on new work. In these last nine years about 2,100 miles have been constructed and thus making the cost about 13,500 piastres per mile of colonial road; from 1912, when it was 8,300 piastres it attained 16,600 piastres in 1920.

Some 250 miles are built annually and as 2,857 miles out of 5,568 are already completed it will require another ten years to complete the present program.

Up to 1919 the local budgets paid for the upkeep of these roads, but now this is provided out of the general budget. In 1920 the 2,500 miles already in service cost 1,600,000 piastres making 640 piastres per mile. As may be expected this rate varies considerably in the various countries of the union; in Cochin-China where the motor traffic is very intense it is as high as 728 piastres, while the military roads of Upper Tonkin cost only 480 piastres per mile.

2. Local Roads

In 1920, 97 miles of new roads were metalled, and 207 miles simply graded. By the end of that year 3,604 miles had been metalled and 4,085 miles graded out of a total of 10,861 miles. The local budgets provided in that same year a sum of 2,075,760 piastres, of which 785,000 was for new work.

By the end of 1921 another 124 miles of local roads had been metalled, for which a provision of 2,375,000 piastres had been made, 1,100,000 for new work and 1,275,000 for upkeep. To these figures must be added 270,000 piastres in 1920 and 230,000 piastres in 1921 provided out of the general budget.

The average cost per mile of local roads which in 1912 varied between 5,760 and 6,560 piastres was in 1920 about 8,800; the cost per mile of upkeep amounted to 368 piastres.

MOTOR ROADS IN JAPAN

(Continued from page 350)

bituminous macadam road then motor buss services will be inaugurated. The Kobe-Osaka road will be built on the same basis and offers equal opportunity.

Of the present roads leading out of the six major cities, those in the neighborhood of Nagoya are the best with the southern roads out of Yokohama leading to Kamakura and Odawara, two very popular resorts and tourists' goals, a good second. It was found during the road survey by the writer that the best streets and roads were those over which, comparatively, traffic was light. In Kyoto and Nagoya, for instance, are many miles of wide, smooth dirt streets, but in both these places the number of motor vehicles are few, due principally to the negligence of distributors, a subject which is treated further in this report.

Aside from the Osaka-Kobe and Yokohama-Tokyo highways, the improvements in roads will most likely follow the present method of levelling and spreading river bed gravel and widening them to the prescribed width. This will encourage motoring, but such roads are not conducive to inter-city freight hauling, a movement, which, at the present time, seems remote, aside from the two sections mentioned where, most certainly, it will develope for great volumes of freight are carried between the cities to the sea, Yokohama being the harbor for Tokyo and Kobe for Osaka.

Summed up official Japan realizes the need of good roads and has started to get them. What is more important, however, is an awakening of the public consciousness on the subject and this can be brought about if an active good roads organization would conduct educational campaigns along the lines successfully followed in the United States. There is a good roads association in Tokyo known as " Doro Kairyo Kwai " with office at Marunouchi, Kojimachi. It is headed by Viscount Y. Shibusawa who is very much interested in all public improvements, and has a membership of about 300. The

secretary is Kakichi Uchida. Unfortunately it is not active and is not supported by the people who would benefit from the good roads movement, namely the road builders, road machinery companies, and automotive men. If the manufacturers represented in Japan could continue to emphasize on their distributers the value of their association with such an organization, benefits would surely follow. Such an organization could serve as the medium for the direction of road publicity in the press. The failure of automotive dealers to realize on this opportunity is an instance of their lack of appreciation of the requirements of progressive automotive distribution. Several of the firms which sell road machinery and materials have brought engineers to the country and they have done valuable work, but the task is so great, the co-ordination of all agencies is required.

Obstacles to Auto Industry in Japan

WHEN the world hears of something that the Japanese cannot duplicate, and then make to sell at a profit, it has every reason for expressing surprise. So mild astonishment was registered when Y. Yamanaka, of Osaka, said that his people could not profitably manufacture automobiles. Mr. Yamanaka is the only manufacturer of automobiles in Japan. He came to Detroit recently to visit an automobile factory.

In the first place the problem of quantity production arose to confront the oriental maker. Here quantity of output appreciably brought down unit cost, in some instance reducing it to scarcely more than a nominal figure considering what was turned out. In Japan this was not possible unless an enormous sum of money was invested and several years taken to adopt to Japanese conditions some effective American system. Now, even at the low wage of labor, so many men in Japan have to be concentrated upon one job, aud kept on it until it is finished, that the unit represents a prohibitive excess of time and money.

Mr. Yamanaka pointed out that even with the additional import duty of 50 per cent., America could put a car down anywhere in Japan at a price so low that Japanese cars could not possibly compete. The government, instead of encouraging the native manufacturer does the reverse, and further handicaps them by the imposition of excise taxes. If the duty on foreign makes of cars was doubled, and the Japanese excise taxes maintained, imported machines would still have the best of it.

If Japan's market for cars was greater, it was contended, there might still be a chance for the native manufacturer because persistence is a national characteristic, and in time the government would be forced to make tax concessions. But there is little immediate chance of improvement taking place. Tax is imposed on gasoline to such an extent that prospective purchasers of cars are deterred. There are different general and local taxes, which combined with the cost of placing the fuel on the market make the wholesale price about four or five times greater than it is in the United States. Efforts have been made, and are being kept up, to force a lowering of gasoline taxes which now militate against ssles.

Highways and streets in Japan are generally in miserable shape. In the important tourist-visited places fairly good pavements are maintained, but in small towns, and in the country, most of the roads are impassable for the greater part of a year. American cars have the inside track, but their stiffest competition comes from the small European machines the gas consumption of which is claimed to be low. The thing that operates against them, however, is the difficulty of securing service and parts. With the American cars there is an interchangability and a definite service which outweighs all other arguments.—*Detroit Evening News.*

Bamboo Roads in Burma

IN the Tavoy district, Lower Burma, the rainfall during the monsoon season is exceptionally heavy. In the middle of this season it was necessary to haul wolfram ore over ten miles of jungle road which the bull-cart traffic had reduced to a series of morasses or bogs. The road was first corduroyed which 3-inch and 4-inch saplings and these were covered with a few inches of laterite. In carting the laterite the few good portions of the road were badly cut up and the job was costing about $28.80 per 100 feet.

Bamboos of 2-inch diameter were split into four sections and laid longitudinally at 1-foot centres along the road. Similar quarter sticks were closely woven in sets of two across the longitudinal strips, two over and two under. The alternate longitudinals were held up while the cross pairs were put in and then tapped back into position. The contract for the road, including the rough leveling was let at $5.76 per 100 feet, and 100 coolies could cut and lay 1,000 feet per day. The hard, external part of the bamboo was always laid upward.

To split the bamboo, a rough cross is erected about three feet above the ground and against a firm wooden frame. The end of the bamboo is slightly split twice with a dah, and the four pieces are thrust through the angles of the cross with a good push.